MECHANICS' MAGAZINE,

AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

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The introduction of new inventions seemeth to be the very chief of all human actions. The benefits of new inventions may extend to all mankind universally, but the good of political achievements can respect but some particular cantons of men. These latter do not endure above a few ages—the former, forever. Inventions may make all men happy without either injury or damage to any one single person. Furthermore new inventions are, as it were, new erections and imitations of God's own works.

BACON.

[*For description, see page 7.*]

TO THE READER.

IN offering to the notice of the public the first number of the "MECHANICS' MAGAZINE, AND REGISTER OF INVENTIONS AND IMPROVEMENTS," we feel that we are rendering a service to that important and intelligent part of the community, the Mechanics of the United States, by introducing to them a journal so cheap as to be within the reach of all,—and so useful, that we trust few will be satisfied to be without it.

We look with confidence to the artisan for that patronage which it shall be our constant aim to merit. Our Magazine will consist of a digested selection of the best articles from numerous scientific and literary works published in Europe, accompanied by graphic illustrations on wood, many of which are almost unknown in this country. Its pages will always be open for the communications of the intelligent of all classes, but to the practical artisan we trust we shall be indebted for many useful

accounts of their experiments, inventions, and discoveries; and we most earnestly solicit their friendly aid and correspondence. It shall be our constant endeavor to be useful, but where we can blend information with amusement, we shall not fail to embrace the opportunity. We are convinced that science can be conveyed in an interesting and amusing form, to a much greater extent than has yet been attempted in this country; and our readers, we are sure, will concur in that opinion after they have perused with attention the following eloquent remarks from the pen of HENRY BROUGHAM, *Lord High Chancellor of England*, on the "Pleasures and Advantages of Science." These remarks are so congenial with our own feelings, and so well describe the principles upon which it is our wish and intention to be guided in conducting this journal, that we insert them with much pleasure —convinced that they will form a far better introductory notice to our readers, than any arguments that we could possibly advance.

ON THE PLEASURES AND ADVANTAGES OF SCIENCE.—Man is composed of two parts, body and mind, connected indeed together, but wholly different from one another. The nature of the union—the part of our outward and visible frame in which it is peculiarly formed—or whether the soul be indeed connected or not with any particular portion of the body, so as to reside there—are points as yet wholly hid from our knowledge, and which are likely to remain forever concealed. But this we know, as certainly as we can know any truth, that there is such a thing as the *Mind;* and that we have at the least as good proof of its existence, independent of the Body, as we have of the existence of the Body itself. Each has its uses, and each has its peculiar gratifications. The bounty of Providence has given us outward senses to be employed, and has furnished the means of gratifying them in various kind, and in ample measure. As long as we only taste those pleasures according to the rules of prudence and of our duty, that is, in moderation for our own sakes, and in harmlessness towards our neighbors, we fulfil rather than thwart the purpose of our being. But the same bountiful Providence has endowed us with the higher nature also—with understandings, as well as with senses—with faculties that are of a more exalted order, and admit of more refined enjoyments, than any to which the bodily frame can minister; and by pursuing such gratifications, rather than those of mere sense, we fulfil the most exalted ends of our creation, and obtain both a present and a future reward. These things are often said, but they are not therefore the less true, or the less worthy of deep attention. Let us mark their practical application to the occupations and enjoyments of all branches of society, beginning with those who form the great bulk of every community, the working classes, by what names soever their vocations may be called—professions, arts, trades, handicrafts, or common labor.

1. The first object of every man who has to depend upon his own exertions must needs be to provide for his daily wants. This is a high and important office; it deserves his utmost attention; it includes some of his most sacred duties, both to himself, his kindred, and his country; and although, in performing this task, he is only influenced by a regard to his own interest, or by his necessities, yet it is an employment which renders him truly the best benefactor of the community he belongs to. All other pursuits must give way to this; the hours which he devotes to learning must be after he has done his work; his independence, without which he is not fit to be called a man, requires first of all that he should have insured for himself, and those dependent on him, a comfortable subsistence, before he can have a right to taste any indulgence, either of his senses or of his mind; and the more he learns—the greater progress he makes in the sciences—the more will he value that independence, and the more will he prize the industry, the habits of regular labor, whereby he is enabled to secure so prime a blessing.

In one view, it is true, the progress which he makes in science may help his ordinary exertions, the main business of every man's life. There is hardly any trade or occupation in which useful lessons may not be learnt by studying one science or another. The necessity of science to the more liberal professions is self-evident; little less manifest is the use to their members of extending their knowledge beyond the branches of study with which their several pursuits are peculiarly conversant. But the other departments of industry derive hardly less benefit from the same source. To how many kinds of workmen must a knowledge of Mechanical Philosophy be useful! To how many others does Chemistry prove almost necessary! Every one must with a glance perceive that to engineers, watch-makers, instrument-makers, bleachers, and dyers, those sciences are most useful, if not necessary. But carpenters and

masons are surely likely to do their work better for knowing how to measure, which Practical Mathematics teaches them, and how to estimate the strength of timber, of walls, and of arches, which they learn from Practical Mechanics; and they who work in various metals are certain to be the more skilful in their trades for knowing the nature of those substances, and their relations to both heat and other metals, and to the airs and liquids they come in contact with. Nay, the farm-servant, or day-laborer, whether in his master's employ, or tending the concerns of his own cottage, must derive great practical benefit—must be both a better servant, and a more thrifty, and therefore comfortable, cottager, for knowing something of the nature of soils and manures, which Chemistry teaches, and something of the habits of animals, and the qualities and growth of plants, which he learns from Natural History and Chemistry together. In truth, though a man be neither mechanic nor peasant, but only one having a pot to boil, he is sure to learn from science lessons which will enable him to cook his morsel better, save his fuel, and both vary his dish and improve it. The art of good and cheap cookery is intimately connected with the principles of chemical philosophy, and has received much, and will yet receive more, improvement from their application. Nor is it enough to say, that philosophers may discover all that is wanted, and may invent practical methods, which it is sufficient for the working man to learn by rote, without knowing the principles. He never will work so well if he is ignorant of the principles,—and for a plain reason: if he only learn his lesson by rote, the least change of circumstances puts him out. Be the method ever so general, cases will always arise in which it must be varied in order to apply; and if the workman only knows the rule without knowing the reason, he must be at fault the moment he is required to make any new application of it. This, then, is the *first* use of learning the principles of science: it makes men more skilful, expert, and useful, in the particular kinds of work by which they are to earn their bread, and by which they are to make it go far, and taste well, when earned.

2. But another use of such knowledge to handicraftsmen is equally obvious: it gives every man a chance, according to his natural talents, of becoming an improver of the art he works at, and even a discoverer in the sciences connected with it. He is daily handling the tools and materials with which new experiments are to be made; and daily witnessing the operations of Nature, whether in the motions and pressures of bodies, or in their chemical actions on each other. All opportunities of making experiments must be unimproved, all appearances must pass unobserved, if he has no knowledge of the principles; but with this knowledge he is more likely than another person to strike out something new which may be useful in art, or curious or interesting in science. Very few great discoveries have been made by chance and by ignorant persons, much fewer than is generally supposed. It is commonly told of the steam-engine, that an idle boy being employed to stop and open a valve, saw that he could save himself the trouble of attending and watching it, by fixing a plug upon a part of the machine which came to the place at the proper times, in consequence of the general movement. This is possible, no doubt, though nothing very certain is known respecting the origin of the story; but improvements of any value are very seldom indeed so easily found out, and hardly another instance can be named of important discoveries so purely accidental. They are generally made by persons of competent knowledge, and who are in search of them. The improvements of the steam-engine by Watt resulted from the most learned investigation of mathematical, mechanical, and chemical truths. Arkwright devoted many years, five at the least, to his invention of spinning-jennies, and he was a man perfectly conversant in every thing that relates to the construction of machinery: he had minutely examined it, and knew the effects of each part, though he had not received any thing like a scientific education. If he had, we should in all probability have been indebted to him for scientific discoveries, as well as practical improvements. The most beautiful and useful invention of late times, the safety-lamp, was the reward of a series of philosophical experiments made by one thoroughly skilled in every branch of chemical science. The new process of refining sugar, by which more money has been made in a shorter time, and with less risk and trouble, than was ever perhaps gained from an invention, was discovered by a most accomplished chemist,* and was the fruit of a long course of experiments, in the progress of which, known philosophical principles were constantly applied, and one or two new principles ascertained. But in so far as chance has any thing to do with discovery, surely it is worth the while of those who are constantly

* Edward Howard, brother of the Duke of Norfolk.

working in particular employments to obtain the knowledge required, because their chances are greater than other people's of so applying that knowledge as to hit upon new and useful ideas; they are always in the way of perceiving what is wanting, or what is amiss in the old methods; and they have a better chance of making the improvements. In a word, to use a common expression, they are in the way of good luck; and if they possess the requisite information, they can take advantage of it when it comes to them. This, then, is the *second* great use of learning the sciences: it enables men to make improvements in the arts, and discoveries in philosophy, which may directly benefit themselves and mankind.

3. Now, these are the *practical* advantages of learning; but the *third* benefit is, when rightly considered, just as practical as the other two—the pleasure derived from mere knowledge, without any view to our own bodily enjoyments; and this applies to all classes, the idle as well as the industrious, if, indeed, it be not peculiarly applicable to those who enjoy the inestimable blessing of having time at their command. Every man is by nature endowed with the power of gaining knowledge; and the taste for it, the capacity to be pleased with it, forms equally a part of the natural constitution of his mind. It is his own fault, or the fault of his education, if he derives no gratification from it. There is a satisfaction in knowing what others know—in not being more ignorant than those we live with: there is a satisfaction in knowing what others do not know—in being more informed than they are. But this is quite independent of the pure pleasure of knowledge—of gratifying a curiosity implanted in us by Providence, to lead us towards the better understanding of the universe in which our lot is cast, and the nature wherewithal we are clothed. That every man is capable of being delighted with extending his information upon matters of science, will be evident from a few plain considerations.

Reflect how many parts of the reading, even of persons ignorant of all sciences, refer to matters wholly unconnected with any interest or advantage to be derived from the knowledge acquired. Every one is amused with reading a story; a romance may divert some, and a fairy tale may entertain others; but no benefit beyond the amusement is derived from this source; the imagination is gratified; and we willingly spend a good deal of time and a little money in this gratification, rather than in resting after fatigue, or in any other bodily indulgence. So we read a newspaper, without any view to the advantage we are to gain from learning the news, but because it interests and amuses us to know what is passing. One object, no doubt, is to become acquainted with matters relating to the welfare of the country; but we also read the occurrences which do little or not at all regard the public interests, and we take a pleasure in reading them. Accidents, adventures, anecdotes, crimes, and a variety of other things, amuse us, independent of the information respecting public affairs, in which we feel interested as citizens of the state, or as members of a particular body. It is of little importance to inquire how and why these things excite our attention, and wherefore the reading about them is a pleasure: the fact is certain; and it proves clearly that there is a positive enjoyment in knowing what we did not know before; and this pleasure is greatly increased when the information is such as excites our surprise, wonder, or admiration. Most persons who take delight in reading tales of ghosts, which they know to be false, and feel all the while to be silly in the extreme, are merely gratified, or rather occupied, with the strong emotions of horror excited by the momentary belief, for it can only last an instant. Such reading is a degrading waste of precious time, and has even a bad effect upon the feelings and the judgment.* But true stories of horrid crimes, as murders, and pitiable misfortunes, as shipwrecks, are not much more instructive. It may be better to read these than to sit yawning and idle—much better than to sit drinking or gaming, which, when carried to the least excess, are crimes in themselves, and the fruitful parents of many more. But this is nearly as much as can be said for such vain and unprofitable reading. If it be a pleasure to gratify curiosity, to know what we were ignorant of, to have our feelings of wonder called forth, how pure a delight of this very kind does Natural Science hold out to its students! Recollect some of the extraordinary discoveries of Mechanical Philosophy. How wonderful are the laws that regulate the motions of fluids! Is there any thing in all the idle books of tales and

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* *Childrens' Books* have at all times been made upon the pernicious plan of exciting wonder, generally horror, at whatever risk. The folly and misery occasioned by this error, it would be difficult to estimate. The time may come when it will be felt and understood. At present, the inveterate habits of parents and nurses prevent children from benefitting by the excellent lessons of Mrs. Barbauld and Miss Edgeworth.

horrors more truly astonishing than the fact, that a few pounds of water may, by mere pressure, without any machinery—by merely being placed in a particular way—produce an irresistible force? What can be more strange, than that an ounce weight should balance hundreds of pounds, by the intervention of a few bars of thin iron? Observe the extraordinary truths which Optical Science discloses. Can any thing surprise us more, than to find that the color of white is a mixture of all others—that red, and blue, and green, and all the rest, merely by being blended in certain proportions, form what we had fancied rather to be no color at all, than all colors together? Chemistry is not behind in its wonders. That the diamond should be made of the same material with coal; that water should be chiefly composed of an inflammable substance; that acids should be, for the most part, formed of different kinds of air, and that one of those acids, whose strength can dissolve almost any of the metals, should consist of the self-same ingredients with the common air we breathe; that salts should be of a metalic nature, and composed, in great part, of metals, fluid like quicksilver, but lighter than water, and which, without any heating, take fire upon being exposed to the air, and by burning from the substance so abounding in saltpetre and in the ashes of burnt wood:—these, surely, are things to excite the wonder of any reflecting mind—nay, of any one but little accustomed to reflect. And yet these are trifling when compared to the prodigies which Astronomy opens to our view: the enormous masses of the heavenly bodies; their immense distances; their countless numbers; and their motions, whose swiftness mocks the uttermost efforts of the imagination.

Akin to this pleasure of contemplating new extraordinary truths, is the gratification of a more learned curiosity, by tracing resemblances and relations between things which, to common apprehension, seem widely different. Mathematical science, to thinking minds, affords this pleasure in a high degree. It is agreeable to know that the three angles of every triangle, whatever be its size, howsoever its sides may be inclined to each other, are always, of necessity, when taken together, the same in amount: that any regular kind of figure whatever, upon the one side of a right-angled triangle, is equal to the two figures of the same kind upon the two other sides, whatever be the size of the triangle; that the properties of an oval curve are extremely similar to those of a curve, which appears the least like it of any, consisting of two branches of infinite extent, with their backs turned to each other. To trace such unexpected resemblance is, indeed, the object of all philosophy; and experimental science, in particular, is occupied with such investigations, giving us general views, and enabling us to explain the appearances of nature—that is, to show how one appearance is connected with another. But we are now considering only the gratification derived from learning these things.

It is surely a satisfaction, for instance, to know that the same thing, or motion, or whatever it is, which causes the sensation of heat, causes also fluidity, and expands bodies in all directions; that electricity, the light which is seen on the back of a cat when slightly rubbed on a frosty evening, is the very same matter with the lightning of the clouds; that plants breathe like ourselves, but differently by day and by night; that the air which burns in our lamps enables a balloon to mount, and causes the globules of the dust of plants to rise, float through the air, and continue their race—in a word, is the immediate cause of vegetation. Nothing can at first view appear less like, or less likely to be caused by the same thing, than the processes of burning and of breathing—the rust of metals and burning—an acid and rust—the influence of a plant on the air it grows in by night, and of an animal on the same air at any time, nay, and of a body burning in that air; and yet all these are the same operation. It is an undeniable fact, that the very same thing which makes the fire burn, makes metals rust, forms acids, and enables plants and animals to breathe; that these operations, so unlike to common eyes, when examined by the light of science, are the same—the rusting of metals—the formation of acids—the burning of inflammable bodies—the breathing of animals—and the growth of plants by night. To know this is a positive gratification. Is it not pleasing to find the same substance in various situations extremely unlike each other; to meet with fixed air as the produce of burning, of breathing, and of vegetation; to find that it is the choke-damp of mines, the bad air in the grotto at Naples, the cause of death in neglecting brewers' vats, and of the brisk and acid flavor of Seltzer and other mineral springs? Nothing can be less like than the working of a vast steam-engine, of the old construction, and the crawling of a fly upon the window. Yet we find these two operations are performed by the same means, the weight of the atmosphere, and

that a sea-horse climbs the ice-hills by no other power. Can any thing be more strange to contemplate? Is there in all the fairy tales that ever were fancied any thing more calculated to arrest the attention and to occupy and to gratify the mind, than this most unexpected resemblance between things so unlike to the eyes of ordinary beholders? What more pleasing occupation than to see uncovered and bared before our eyes the very instrument and the process by which Nature works? Then we raise our views to the structure of the heavens; and are again gratified with tracing accurate but most unexpected resemblances. Is it not in the highest degree interesting to find, that the power which keeps this earth in its shape, and in its path, wheeling upon its axis round the sun, extends over all the other worlds that compose the universe, and gives to each its proper place and motion; that this same power keeps the moon in her path round our earth, and our earth in its path round the sun, and each planet in its path; that the same power causes the tides upon our globe, and the peculiar form of the globe itself; and that, after all, it is the same power which makes a stone fall to the ground? To learn these things, and to reflect upon them, occupies the faculties, fills the mind, and produces certain as well as pure gratification.

But if the knowledge of the doctrines unfolded by science is pleasing, so is the being able to trace the steps by which those doctrines are investigated, and their truth demonstrated: indeed you cannot be said, in any sense of the word, to have learnt them, or to know them, if you have not so studied them as to perceive how they are proved. Without this you never can expect to remember them long, or to understand them accurately; and that would of itself be reason enough for examining closely the grounds they rest on. But there is the highest gratification of all, in being able to see distinctly those grounds, so as to be satisfied that a belief in the doctrines is well founded. Hence to follow a demonstration of a grand mathematical truth—to perceive how clearly and how inevitably one step succeeds another, and how the whole steps lead to the conclusion—to observe how certainly and unerringly the reasoning goes on from things perfectly self-evident, and by the smallest addition at each step, every one being as easily taken after the one before as the first step of all was, and yet the result being something not only far from self-evident, but so general and strange, that you can hardly believe it to be true, and are only convinced of it by going over the whole reasoning—this operation of the understanding, to those who so exercise themselves, always affords the highest delight. The contemplation of experimental inquiries, and the examination of reasoning founded upon the facts which our experiments and observations disclose, is another fruitful source of enjoyment, and no other means can be devised for either imprinting the results upon our memory, or enabling us really to enjoy the whole pleasures of science. They who found the study of some branches dry and tedious at the first, have generally become more and more interested as they went on; each difficulty overcome gives an additional relish to the pursuit, and makes us feel, as it were, that we have by our work and labor established a right of property in the subject. Let any man pass an evening in vacant idleness, or even in reading some silly tale, and compare the state of his mind when he goes to sleep or gets up next morning with its state some other day, when he has passed a few hours in going through the proofs, by facts and reasoning, of some of the great doctrines in Natural Science, learning truths wholly new to him, and satisfying himself by careful examination of the grounds on which known truths rest, so as to be not only acquainted with the doctrines themselves, but able to show why he believes them, and to prove before others that they are true; he will find as great a difference as can exist in the same being—the difference between looking back upon time unprofitably wasted, and time spent in self-improvement; he will feel himself in the one case listless and dissatisfied, in the other comfortable and happy: in the one case, if he do not appear to himself humbled, at least he will not have earned any claim to his own respect,—in the other case, he will enjoy a proud consciousness of having, by his own exertions, become a wiser and therefore a more exalted creature.

To pass our time in the study of the sciences, in learning what others have discovered, and in extending the bounds of human knowledge, has in all ages been reckoned the most dignified and happy of human occupations; the name of Philosopher, or Lover of Wisdom, is given to those who lead such a life. But it is by no means necessary that a man should do nothing else than study known truths, and explore new, in order to earn this high title. Some of the greatest philosophers in all ages have been engaged in the pursuits of active life; and an assiduous devotion of the bulk of

our time to the work which our condition requires, is an important duty, and indicates the possession of practical wisdom. This, however, does by no means hinder us from applying the rest of our time, besides what nature requires for meals and rest, to the study of science; and he who, in whatever station his lot may be cast, works his day's work and improves his mind in the evening, as well as he who, placed above such necessity, prefers the refined and elevating pleasures of knowledge to the low gratification of the senses, richly deserves the name of a true philosopher.

One of the most delightful treats which science affords us is the knowledge of the extraordinary powers with which the human mind is endowed. No man, until he has studied philosophy, can have a just idea of the great things for which Providence has fitted his understanding—the extraordinary disproportion which there is between his natural strength and the powers of his mind, and the force he derives from them. When we survey the marvellous truths of Astronomy, we are first of all lost in the feeling of immense space, and of the comparative insignificance of this globe and its inhabitants. But there soon arises a sense of gratification and of new wonder at perceiving how so insignificant a creature has been able to reach such a knowledge of the unbounded system of the universe—to penetrate, as it were, through all space, and become familiar with the laws of nature at distances so enormous as baffle our imagination—to be able to say, not merely that the Sun has 329,630 times the quantity of matter which our globe has, Jupiter $308\frac{9}{10}$, and Saturn $93\frac{1}{2}$ times; but that a pound of lead weighs at the Sun, 22 lbs. 15 ozs. 16 dwts. 8 grs. and $\frac{3}{4}$ of a grain! at Jupiter, 2 lbs. 1 oz. 19 dwts. 1 gr. $\frac{20}{43}$! and at Saturn, 1 lb. 3 ozs. 8 dwts. 20 grs. $\frac{1}{11}$ part of a grain! And what is far more wonderful, to discover the laws by which the whole of this vast system is held together and maintained through countless ages in perfect security and order. It is surely no mean reward of our labor to become acquainted with the prodigious genius of those who have almost exalted the nature of man above its destined sphere: when admitted to a fellowship with those loftier minds, we discover how it comes to pass that, by universal consent, they hold a station apart, rising over all the great teachers of mankind, and spoken of reverently, as if NEWTON and LAPLACE were not the names of mortal men.

The highest of all our gratifications in the contemplations of science remains: we are raised by them to an understanding of the infinite wisdom and goodness which the Creator has displayed in his works. Not a step can we take in any direction without perceiving the most extraordinary traces of design; and the skill every where conspicuous is calculated, in so vast a proportion of instances, to promote the happiness of living creatures, and especially of our own kind, that we can feel no hesitation in concluding that, if we knew the whole scheme of Providence, every part would be found in harmony with a plan of absolute benevolence. Independently, however, of this most consoling influence, the delight is inexpressible of being able to follow, as it were, with our eyes, the marvellous works of the Great Architect of Nature—to trace the unbounded power and exquisite skill which are exhibited in the most minute, as well as the mightiest, parts of his system. The pleasure derived from this study is unceasing, and so various that it never tires the appetite. But it is unlike the low gratifications of sense in another respect: while those hurt the health, debase the understanding, and corrupt the feelings, this elevates and refines our nature, teaching us to look upon all earthly objects as insignificant and below our notice, except the pursuit of knowledge and the cultivation of virtue; and giving a dignity and importance to the enjoyment of life, which the frivolous and the grovelling cannot even comprehend.

Let us, then, conclude, that the pleasures of science go hand in hand with the solid benefits derived from it; that they tend, unlike other gratifications, not only to make our lives more agreeable, but better; and that a rational being is bound by every motive of interest and of duty, to direct his mind towards pursuits which are found to be the sure path of virtue as well as of happiness.

HOLT'S NEW HOTEL.—We have given on our first page a correct engraving of this splendid edifice, which was completed during the last year; and as it is one of the most prominent buildings in this city, we have selected it as the first of a series of views in New York and its vicinity, which we purpose from time to time to present to our readers. Those who have only seen the outside, can form very little idea of the regularity and order which is observed in conducting the internal arrangements. The worthy host appears to have *a place for every thing, and every thing in its place;* it combines

all the advantages of a hotel and boarding house, and to the casual visiter of this city, as well as to those whose ordinary occupations require them to locate in it, or its vicinity, it affords every advantage that could be desired Every delicacy can be obtained by, and every attei tion is paid to, the wishes of the guest.

As we conceive a detailed description o the building may be interesting to our readers, we shall subjoin one we have been favored with from a source which, we are satisfied, cannot but be correct.

It stands on a base of 7 feet, with a foundation of 3 feet—the basement wall is 2 feet 6 inches, and all the main walls are 20 inches thick. The basement and first story are of Hallowell granite—the five stories above, and the tower, of marble; and in order to add to the security of the building, all the main joints of the marble and granite are clamped together, and then made fast to iron straps or bars, which extend, some twenty, others thirty feet, into the partition or division walls, with anchors at the end. The corners are also secured by anchors or bars of iron in each direction, twelve feet in length. For the above purposes alone, ten tons of iron were used.

Three of the sides front on three different streets, viz.: Water street, Fulton street, and Pearl street. In the engraving affixed is a view of the front in Water street, and a side view of that in Fulton street. Its breadth in Water street is 85 feet 6 inches—in Fulton street 100 feet—and in Pearl street 76 feet 6 inches; the principal entrances are in Water street. In the relish room there can be found superior accommodation, on terms as reasonable as at any establishment in this city.

A great portion of the basement is devoted to cooking rooms and other necessary purposes. In the yard, under a platform, is a steam engine of 12 horse power, which is daily used to bore for pure water—already it has penetrated upwards of 500 feet into the earth; it is applied also to turning of spits—to grinding and cleaning knives; it abridges labor by carrying up the dishes, when cooked, to each story—the baggage also is in this manner conveyed to their several places of destination. On the Pearl street and Fulton street sides are several stores, which are let out for various purposes of trade.

In the 2d story will be found a dining room 100 feet in length, fronting Fulton street; the Water street side is a large room, in which there is daily a Public Ordinary, and to which resort many of the most respectable and influential men of the city. There are also other rooms used as parlors, with the privilege of a private staircase and a spacious Hall.

In the 3d story are apartments judiciously constructed for the use of families, consisting of elegant and pleasant sitting rooms, and one, two or more bed rooms, as may be necessary, with every convenience that can be desired.

The 4th, 5th and 6th, are also divided into parlors and bed rooms to suit the convenience of smaller families, and of travellers who wish to have private apartments. Three hundred persons may be accommodated with lodgings; and one thousand can sit at the different tables, at the same time.

On the roof, enclosed by a substantial iron railing, is a spacious promenade, for the convenience of visiters, which will accommodate 500 persons; when the weather permits, it commands a beautiful prospect of the surrounding country, and of the shipping in the river, and much amusement is afforded by witnessing the bustle below of arrivals and departures of steamboats and other conveyances.

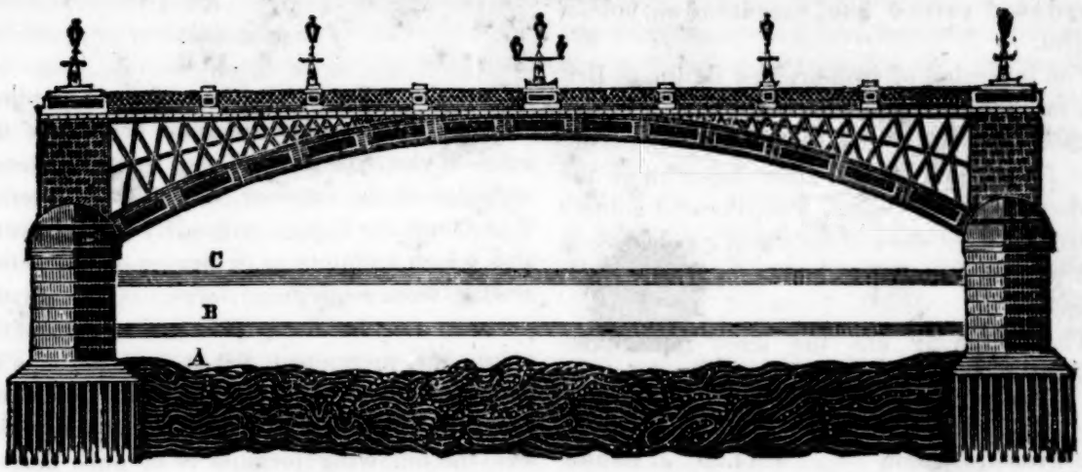
In the attic story there is a saloon provided with refreshments of all kinds for the accommodation of visiters to the promenade. There are also separate bathing rooms.

The dome is built immediately over the basement, and in it there is room for a full band of musicians.

The height of the building from the first floor is 135 feet; and for convenience of arrangement, or excellence of construction, it is undoubtedly equal to any other edifice in this country.

As this magnificent mansion has been reared by the persevering industry and economy of one individual, we think that a short account of his progress in life since his first arrival in this city cannot fail to be interesting, and it will afford an additional proof of what can be accomplished by such means, and more especially exhibit to our younger readers the value of pursuing through life an undeviating course of integrity and honor. It is by such a course only that they can arrive at that high distinction which Mr. Holt has arrived at, viz. to be *respected, and enjoy the good wishes of all* that have the pleasure of knowing him.

It was our intention to have accompanied the preceding with a brief memoir of the MECHANIC and Gentleman, who, by quiet industry, has accomplished so much in a few years, notwithstanding he once, in the mean time, lost every thing he possessed, by fire, but want of room compels us to defer it until another time.



A, bed of the river—B, low water mark—C, high water mark.

[*From the London Mechanics' Magazine.*]

SOUTHWARK IRON BRIDGE. Architect, Rennie. 1814–20.

For several centuries the only direct means of communication from the Borough of Southwark to the city of London was by passing over London Bridge, the then only bridge across the river Thames. Since the time of Stowe, however, (who mentions that bridge with particular satisfaction,) the rapid extension of the Borough had frequently suggested the great necessity of some more direct means of communication to the heart of the city. But it was to our own times that the ultimate execution of his design was reserved. The successful projector of the scheme was Mr. John Wyatt, proprietor of the Repertory of Arts. In 1807, that gentleman first turned his attention to the subject, and labored incessantly, and in spite of every obstacle, till the year 1811, when an Act of Parliament was obtained, authorizing the necessary sums to be raised, amounting in the gross to 400,000*l.* in transferable shares of 100*l.* each; and containing permission to raise (by way of mortgage or annuities) the sum of 100,000*l.* should such further sum be required to complete the works with its necessary approaches, and for securing the subscribers against extra calls over and above the amount originally stipulated for.

The Committee of the proposed Bridge consisted of the following gentlemen:—Sir J. Jackson, Bart. chairman; John Allnut, Esq. Chas. Barclay, Esq. M. P. Samuel Davis, Esq. East India Director; Robert Pott, Esq. Henry Perkins, Esq. Charles Price, Esq. George Ranking, Esq. John Ramsbottom, Esq. M. P. Wm. Salte, Esq. William Slade, Esq. John Taylor, Esq. M. P. William Williams, Esq. Banker; and Sir Joseph Yorke, Bart. M. P. Whether any other committee was formed prior to this I am unable to determine, but the before-mentioned names agree with those given in the "Repertory," as also in the copy of a Prospectus now before me.

Mr. Wyatt, it appears, was at the time personally acquainted with the late John Rennie, Esq. who, at his (Mr. Wyatt's) recommendation, had professional conferences with the Committee of Management on the propriety of erecting the bridge, and the nature of its construction. Mr. Rennie was, of course, satisfied that a bridge was required, and the Committee being satisfied that the care of its execution could not well be placed in abler hands, gave the necessary directions for designs and drawings to be prepared for their inspection. Accordingly Mr. Rennie furnished two designs for the intended bridge; one of stone, to consist of five arches, and one of iron, to consist of three arches, with granite piers. The latter design was preferred and carried into execution. (See above engraving of centre arch.)

The works, however, were not commenced until the year 1814—operations being stayed by parliament till such time as all the shares were disposed of. It must be admitted that this undertaking of Mr. Rennie's was bold and arduous in the extreme. Little is known at present as to the best mode of constructing bridges of iron. The great number of the parts, and the paucity of scantling compared with stone bridges, and the immense labor in fixing those parts, render it, in many respects, a distinct arrangement in bridge-building. Also, if we consider the enormous spans of the arches of Southwark Bridge, and the number of them (only three), we cannot withhold our commendation from the scientific individual who con-

ceived and carried into execution so bold a project.

The invention of iron bridges is due to British mechanics. It is said that the first bridge of this description was invented by Mr. Thomas Paine, and intended for America as the subjoined list will show. The repeated failures of iron bridges show clearly that experience is still wanting to render them of sufficient permanency.

The following are the most remarkable Bridges of Iron not of the suspension kind:

	Dates.	Architects or Builders.
Southwark, London	1814.20	J. Rennie
Colebrook Dale, over the Severn	1779	Darby
Mr. Paine's bridge, intended for America, but not having money sufficient the arch was taken down by the builders, Messrs. Walker, of Rotheram; part of the materials were employed in building Sunderland and Wearmouth in 1790.	1790	
Over the River Wear	1793.6	Walker, Wilson, Burden
Buildwas, (Colebrook Dale Company)	1795.6	Telford
Tame, Herefordshire—when centering was removed (failed)	1795.6	
Parret, at Bridgewater, Dale Company	1796	
Staines (failed twice)	1800	
Tees at Yarm (failed)		
Boston, in Lincolnshire, and two over the New River at Bristol.		

[*From the American Railroad Journal.*]

Mr. Editor—Should you consider the following formulas, relating to the effect of grade and curvature upon the motion of Railroad cars, to be of any value to the readers of your Journal, they are offered to you for insertion.

In estimating the effect of curvature, it is necessary to have a general formula for the value of the centrifugal force. Take V = the velocity of a car in miles per hour; R = the radius of curvature of the track in feet; w = the weight of the car in lbs.; and f = the centrifugal force in lbs. From known principles, the following expression for the value of f is obtained:

$$f = w \times \frac{V^2}{15\,R}$$

Now the effect of the force f is to produce a continued pressure upon the bearing of the axles of the wheels, and also upon the flange and edge of the exterior rail. Take therefore T to denote the friction caused by that pressure, and which amounts to the increase of traction arising from centrifugal force. Although the pressure may be nearly the same at both of the points just mentioned, yet it may perhaps be sufficient to take the amount of friction equal to $\frac{1}{4}$ of the whole centrifugal force,* in which case the following formula is at once derived from the preceding:

$$T = w \times \frac{V^2}{60\,R}$$

In making a selection, from different routes, for the location of a line of Railroad, it may sometimes be necessary to compare grades with curvatures. Thus, the traction arising from grade alone is expressed by the quantity $w \times \frac{n}{\sqrt{1+n^2}}$, or simply by $w \times n$, very nearly; in which n represents the rise or fall in the distance unity: and therefore, when the traction arising from an ascending grade is equal to that arising from curvature, the following formula obtains: $n = \frac{V^2}{60\,R}$

From which either of the three quantities, n, V, or R, may be found when the other two are given; and thus it is easy to compute what grades and curvatures are equivalent to each other, as regards traction, with any given velocity.

In order to express a general formula for the traction, when the road-way has both inclination and curvature, let $w \times m$ be the traction upon a straight horizontal way. The expression for the whole traction T will then evidently be as follows:

$$T = w \times \left\{ m \pm n + \frac{V^2}{60\,R} \right\}$$

This formula will be of use in all cases where it may be desirable to compare the traction, un-

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* It may perhaps seem at first view, that the increase of traction is less than the friction here given, in the ratio of the radius of the wheel to the height of the flange. That, however, would be an error; but whether a different ratio than that of 1 to 4, as here adopted, will best comport with truth, can only be determined from experience.

der circumstances of various loads, grades, curvatures, and velocities.

It may, perhaps, be of some use to investigate a formula for determining the greatest velocity which will comport with safety, upon curves of given radii, and with wheels of given diameters. Let k denote the distance between the axles, and put P = an arc to rad. 1, and length $\frac{k}{2R}$. The two following theorems will give the principles upon which the investigation is made.

1st. The force necessary to cause the flange of a wheel to ascend upon the rail is in a ratio compounded of the sub-duplicate ratio of the height of the flange, and the reciprocal sub-duplicate ratio of the radius of the wheel.

2d. When the force necessary to cause the flange to ascend upon the rail is to the friction of the flange upon the edge of the rail, as radius to Cos. P: then is the car equally liable either to run off the track, or to continue upon it.

The demonstration of these two theorems, which, for the sake of brevity, is omitted, may be easily supplied from received principles of mechanics.

Now, the friction of the flange is as $\frac{V^2}{R}$; and putting r = the radius of the wheel, and h = the height of the flange, the force necessary to raise the flange upon the rail, is as $\left\{\frac{h}{r}\right\}^{\frac{1}{2}}$. But it will, in most cases, be sufficient to take, radius to Cos. P. a radius of equality; in which case $\frac{V^2}{R}$ is as $\left\{\frac{h}{r}\right\}^{\frac{1}{2}}$; that is, V^2 is as $R \times \left\{\frac{h}{r}\right\}^{\frac{1}{2}}$; or, $V^2 = A \times R \times \left\{\frac{h}{r}\right\}^{\frac{1}{2}}$; in which A is some constant quantity, to be ascertained from experience. With wheels five feet in diameter, and flanges $1\frac{1}{4}$ inches in height, and upon a track of 1,000 feet radius, the utmost safe velocity is, perhaps, about 20 miles per hour. Substituting these values in the above equation, the result will give A = 2, very nearly. The general formula will, therefore, be the following:

$$V = \left| 2R \times \left\{\frac{h}{r}\right\}^{\frac{1}{2}} \right|^{\frac{1}{2}}$$

From which it will be easy to compute the greatest safe velocity upon any curve, and with wheels of any diameter. V. D. G.

Lexington and Ohio Railroad, Nov. 27, 1832.

SUBSTITUTE FOR PRINTING.—A new process has been discovered and brought into use at Brussels, whereby French books and journals may be printed with great facility and perfect accuracy. It consists of an operation by which, in less than half an hour, the whole of the letter press upon a printed sheet may be transferred to a lithographic stone, leaving the paper a compiete blank. By means of a liquid, the letters transferred to the stone are brought out in relief within the space of another hour, and then, with the usual application of the ordinary printing ink, 1500 or 2000 copies may be drawn off resembling minutely the original typography. The immense advantages of this discovery, for which M. Mecus Vandermacien has solicited a patent, may be easily conceived. A first application of this discovery has been made by him upon the "Gazette des Tribunaux," which is to appear at Brussels under a new title.—[Rep. Pat. Inv.]

[*From the Journal of the Franklin Institute.*]

AMERICAN PATENTS.

For a Filtering Machine to be used in the Art of Manufacturing Paper; Thomas French, Ithaca, Tompkins County, New-York, May 26.

This machine is to perform the task of what has been usually called a pulp dresser, some of which instruments we have formerly described. A cylindrical vessel of copper, or of brass, is to be made with slots, or openings from top to bottom, exhibiting the appearance of bars about one fourth of an inch wide, and one thirty-second part of an inch asunder. It may be made solid, and afterwards cut in this manner, or it may be composed of metallic bars put together. It may also vary in its form, being either square, polygonal, or otherwise. Its diameter may be fifteen, and its height fourteen inches.

A perforated dasher is to be made to play up and down in this vessel, by means of a crank, giving a velocity of from five to six hundred strokes in a minute. The pulp admitted into it is thus forced through between the bars into a vat below, whilst the knobs, &c. are retained, and are removed, when necessary, through a suitable opening. The rim of the dasher stands about half an inch from the sides of the cylinder, and in its vibration approaches the bottom within half an inch, and the top within four or five inches. To supply the cylinder with stuff, a conductor of the requisite size passes through the top, or cover, of it.

The cylinder is enclosed within a close square

box of wood, and one which has been made of the given dimensions supplies a machine vat which works the pulp beat by two engines. The driving power is said to be equal to about that of a man. If the metallic vessel is made sufficiently strong, so that the bars will not yield to the pressure, the necessity of picking the paper after it is dried is said to be obviated altogether; whilst, from the agitated state in which the pulp is thrown into the vat, the fibres are more perfectly entangled than is general in machine paper, and it is thereby improved in quality.

For an Improvement in the Silk Reel; Charles G. Green, Windsor, Windsor county, Vermont, May 30.

The improvement here described is intended to distribute the silk upon the reel with perfect regularity, and thus to prevent the occurrence of the defect which is known by the name of glazing; and consequently to produce silk of a better quality than can be obtained by the common reel. To effect this purpose the reel is made to traverse backward and forward with perfect regularity; this is done by lengthening out the gudgeons of the shaft of the reel, so that they shall each form cylindrical rods of the full length of the reel itself. These turn in boxes upon the frame of the reel, having a crank upon one of them for that purpose.

These rods may be about an inch in diameter, and upon one of them two channels are cut from end to end, one of these forms a right, and the other a left handed screw. A guide piece in one of the boxes, acting alternately in these grooves, causes the reel to traverse backward and forward. This is the part which forms the subject of the patent, it being the only one in which this reel differs essentially from others.

As there are two cylindrical rods, we should suppose that it would be better to have the right hand screw on one of them, and the left hand screw in the other; as in the machine described, these grooves cut each other in their crossing, at every turn. The principle of action would remain the same, although in the case suggested each box must have its guide piece, which could be engaged and disengaged by very simple gearing.

For an Improvement in the Box and Hub of Wheel Carriages, and in the Method of Hanging Coach Bodies; David Watson, Fayette, Kennebeck county, Maine, May 29.

Boxes are to be made of cast iron, of the usual form on the exterior, but with a rebate at each end in the interior, so as to receive a copper ring, cast for the purpose, which is to be five-eighths of an inch deep, and three-fourths thick. These rings are driven in against a shoulder on each end of the cast iron box, and are secured by rivetting; they form the bearing for the axle, the bore of the cast iron between them being such as to allow a space of three-eighths of an inch between it and the axle.

A hole is to be bored through the hub and the iron box at the middle of the axle, for the purpose of supplying oil. A sponge is to be placed in this hole to retain the oil and lubricate the axle, and it is closed by means of a screw, to prevent the entrance of dirt and water.

In hanging carriage bodies, the first improvement described is the putting of steel rollers three inches long, and an inch and a quarter in diameter, at the upper ends of the jacks, over which the thorough braces pass. Under the body of the carriage, and extending from one end of it to the other, over, and in the direction of, the perch, an elastic beam or strip of wood passes, which is three inches wide, and an inch thick, and this is connected on its under side to levers, by strong spiral springs, which are arranged in a way which could not be clearly explained without the drawings, but which are intended to give the most perfect elasticity to the whole structure, and are, it is averred, capable of being so managed as to cause the passenger to ride with equal ease, whether a stage be loaded lightly or heavily.

The claim is to the copper rimmed boxes, and the mode of applying them; the adaptation of the iron boxes to them; the mode of supplying the oil; and the described manner of hanging the bodies of stages, or other carriages.

Notes of an Observer on an Opinion respecting the Draft in Chimneys; and on another relating to Inertia, which appeared in this Journal. [From the Journal of the Franklin Institute.]

In vol. iii. p. 352, of the Journal of the Franklin Institute, there are some very judicious answers given to some queries on the subject of draft in chimneys. I think, however, the author is wrong in his answer to the 5th question. "Will a chimney largest at the top, or vice versa, make the strongest draft?"

Ans. "As that portion of the column of heated air, &c. nearest the burning coals, must

necessarily be more expanded, and require more room, than at the top of the chimney, where their temperature and volume are diminished, a chimney largest at the bottom must be better calculated to promote a rapid current through it, than the same chimney with its apex reversed." The reason here given is extremely plausible, but I would not rely on it, without experiment, for the following reasons. First, if the upper part of the chimney is enlarged, the friction will be diminished by the diminished velocity. Second, it is highly probable that elastic fluids flowing through tubes have their flow increased by expanding tubes—on the principle of Venturi's adjutages. Because, from the very nature of inertia, whatever velocity may be generated in the lower part, if contracted, it inclines to preserve the same in the wider part above, and thus to increase the draft.

However this may be, I have one remark to make which will be useful to those whose houses smoke in windy weather, or whose furnaces draw worse in windy weather than in calm.

Let a roof, or inclined plane, be made of tin or sheet iron, or boards, from the top of the chimney walls, outwards and downwards, at an angle of 45 degrees with the perpendicular walls; extending two or three feet from the top each way, more or less, according to the size of the chimney. With such an arrangement at the top of a chimney, the draft will be greatly increased by a strong wind. The experiment has been tried at the suggestion of the writer of this paragraph with complete success. The modus operandi is obvious. The more violently the wind blows, the more will the weight of the column of air over the chimney be lifted up by the oblique direction given to it by its striking against the plane; that is, a partial vacuum will be created exactly over the top of the chimney.

It is known that a draft in a chimney may be increased by letting into it highly condensed steam, through a pipe opening upwards: and I have been told by practical engineers, that a greater effect is produced by letting the pipe open low down in the chimney, than near the top.

The reason appears to me to be that the velocity given to the gas in the chimney near the bottom is nearly preserved throughout its whole extent by the nature of inertia.

It might be curious to inquire, what is the velocity with which air moves upwards in a chimney of a given height, with a given temperature above the air on the outside. Now, it is known that if the atmosphere were of a uniform density, equal to that at the surface of the earth, it would be twenty-seven thousand feet high. If a body were to fall freely in vacuo from this height to the earth, it would acquire a velocity of thirteen hundred and thirty feet per second, and this is the velocity with which air would rush, by its own pressure, into a vacuum.

It is also known that the velocity with which fluids are discharged under different pressures, is as the square roots of those pressures; that is, four times the pressure will give double the velocity, and nine times the pressure three times the velocity, &c. If there is pressure both ways, as in the case of one fluid rushing into another, with different heads of pressure, then the velocity will be proportional to the square roots of the differences of pressure. For example, suppose two vessels filled with water, one twenty-seven thousand feet high, and the other sixteen feet higher, and a communication made between these two vessels, either near the top or bottom, the fluid would be discharged with a velocity due to a head of sixteen feet. For the writer of this article demonstrated by experiment that water makes no resistance to water issuing under a given head. The same law will apply to the gases; consequently the resistance at the top of the chimney to the issuing air is nothing. If, now, we ascertain how much less air there is in a chimney in consequence of its rarefaction by heat, we shall be able to calculate the velocity with which the external air moves upwards into it, by the following very simple rule: Multiply the square root of the number of feet which the chimney contains in perpendicular height, less than a column of air of the same height on the outside, by eight, and the product will be the velocity in feet per second with which the air will move into the chimney.—Now it is known that air, at the temperature of 32° of Fahrenheit, has its bulk doubled by an increase of four hundred and eighty degrees of temperature. Suppose, for example, that a chimney is thirty-two feet high, and the temperature of the air on the outside is thirty-two degrees, and the temperature of the air in the chimney, at a mean, four hundred and eighty above thirty-two, then will the quantity of air in the inside of the chimney be only one half of what it is in a column on the outside of similar height. The difference of head, then, will be sixteen feet. The square root of sixteen is

four, and this square root multiplied by eight, the product is thirty-two, which is the velocity with which the air moves per second into the chimney.

Again, suppose the chimney is eight feet high, and the temperature as before. Then will the quantity of air on the outside be four perpendicular feet more than that in the chimney. The square root of four is two, and two multiplied by eight is sixteen, which is the velocity of the air passing into the chimney. Again, suppose the chimney to be two feet high, and the temperature as before, then will the difference of head be one foot, and the square root of one is one, and one multiplied by eight is eight —the velocity per second, in feet, with which the external air moves upwards into the chimney.

As the temperature of the air on the outside of the chimney is not always thirty-two, it is desirable to know what the volume of such air would be at thirty-two.

It may be obtained by the following rule. First, for temperatures above thirty-two: Add the number of degrees of Fahrenheit above thirty-two, to four hundred and eighty, and divide four hundred and eighty times the volume of air on the outside of the chimney by the sum, and the quotient will be the volume of air at the temperature of thirty-two. Again, for temperatures below thirty-two: Subtract the number of degrees of Fahrenheit below thirty-two from four hundred and eighty, and divide four hundred and eighty times the volume of air on the outside of the chimney by the remainder, and the quotient will be the volume of air at the temperature of thirty-two.

As we have now before us data for calculating the velocity with which air rushes into a chimney at any temperature without and within, we will illustrate the rules by one more example. Let the chimney be 32 feet high, and the temperature on the outside be 60 degrees above, and in the inside 480 degrees above 32. Now, let the 480 times 32 be divided by 480 added to 60, and the quotient will be $28\frac{4}{10}$ feet, the column of air on the outside at the temperature of 32. Again, let 480 times 32 be divided by 480 added to 480, and the quotient will be 16 feet, the column of air in the inside of the chimney at the temperature of 32; therefore, the difference of the heads of pressure in this case is 16 subtracted from 28.4, which is 12.4.

If, now, according to the rule given above, the square root of 12.4 be multiplied by 8, the product will be $28\frac{17}{100}$ feet, the velocity with which air at a density due to the temperature of 32 will flow into a chimney at the above temperatures.

In these calculations no allowance is made for friction along the sides of the chimney, and in passing through the fuel at the entrance. Neither has any notice been taken of the fact that the gases which pass up the chimney, after having performed the office of combustion, are always of greater weight than the air which enters.

Even when pure dry carbon is the fuel, if all the oxigen of the air which enters unites with it, the gas which ascends in the chimney is seven and a half per cent. heavier than the air which performs the combustion; and this alone will always diminish the velocity of the entering air more than seven and a half per cent. for that much more matter has been put in motion with a velocity greater than that of the entering air.

If wet materials are used for combustion, the diminution of velocity will be much greater.

It will be seen from the above examples that a chimney thirty-two feet high gives a velocity only double that of one which is one-fourth as high, and only four times greater than that of one which is one-sixteenth as high. And in general, the velocity of air moving up chimneys of different heights, with the same mean temperatures, neglecting friction, is as the square roots of their heights.

These calculations are all made on the supposition that the chimney is of the same diameter throughout. The writer believes the draft would be increased below if the chimney should be widened out a little above the fire; but the exact form, best suited to produce the greatest effect, must be ascertained by experiment. This much may be said, that if the object should be to burn as much coal as possible in a chimney of a given height and diameter, so as to produce the most intense heat possible by a natural draft, the chimney should be of a shape somewhat like Venturi's adjutage, with the fire in the "contracted vein."

If the principles explained above are clearly comprehended, it will be extremely easy to understand another method of ascertaining the velocity with which air rushes up a chimney at any moment, which I now proceed to explain.

Let a tube of glass, of any convenient diameter, of equal bore throughout, be bent as in the adjoining figure, so that its two legs may be parallel, and one of them near the top be bent at right angles, as at *b*. If, now, these two legs be filled to a certain height, *n*, with water, care being taken to keep the legs vertical, and the end *b*, thrust into the chimney just above the fire place, the water will rise in the leg *b*, and sink in the other. Now, as water is 800 times heavier than air, if the difference of the heights of the water in the two legs be multiplied by 800, it will give the head of pressure of air on the outside of the chimney above that within.

If this be reduced to feet, and the square root of the feet be multiplied by eight, it will give the velocity of the air rushing into the chimney as before. Suppose the difference of the height of the water in the two legs is four-tenths of an inch; 800 times four-tenths of an inch is 26.66 feet, and the square root of this multiplied by 8 is 41 feet, which is the velocity with which air rushes into the chimney where the leg of this anemometer is inserted.

As the method by the anemometer gives the actual velocity, free from the uncertainty of friction in the chimney, it will be superior to the former, if no uncertainty should arise from the difficulty of measuring the depression of water in the tube.

I am aware that these calculations are founded principally on theoretical principles, and that they give a velocity about one-sixth greater than Dr. Hutton's experiments on the impulse of air in motion, which appears to me to be the converse of the principles calculated above; yet as experiments differ very widely among themselves, so as to leave great doubt on the subject, and as my calculations are founded on acknowledged principles, I do not hesitate to present them to the readers of the Journal of the Franklin Institute.

In vol. iv. p. 35, there is an essay by Thomas W. Bakewell, Esq. a gentleman who discovers much acuteness of mind on various subjects discussed by him in this journal, which, for that very reason, is the more deserving of notice, since the weight of his authority, if uncontradicted, might with many be considered sufficient to subvert a doctrine which has been universally admitted among philosophers as resting on the immoveable basis of demonstration.

The chief object of the essay under consideration is to show that inertia varies with gravitation. The author says, "If a hundred pound ball were taken to such a distance from the earth as should lessen the attracting force, or weight, to one pound, it would have lost 99 per cent. of its weight or attracting quality, and also 99 per cent. of its impeding quality, inertia, and would therefore be in exactly the same situation as a ball weighing one pound is when sixteen feet from the earth, and would consequently fall from this point in one second of time."

Now this is mere hypothesis, and is besides contrary to known facts. For instance, if the author will put himself to the trouble to calculate how far the moon deviates from a tangent to her orbit in one second of time, he will find that instead of falling below it sixteen feet as his doctrine requires, she falls only $\frac{1}{3600}$ of sixteen feet, the exact distance she should fall on supposition that her inertia is undiminished by her removal from the earth's centre sixty times as far as a body at the surface of the earth, where it is known by experiment she would deviate from a tangent sixteen feet in a second of time, provided she weighs only one hundred pounds. For if the received law of gravitation is correct, and Mr. Bakewell seems to admit it, then the gravitation of the moon to the earth, is only $\frac{1}{3600}$ of what it would be if she was at the earth's surface; that is, sixty times as near the centre of attraction—for sixty times sixty is thirty-six hundred.

If Mr. Bakewell is not satisfied with this single fact, which appears to me decisive, let him calculate how far the several planets fall below a tangent to their orbits in a second of time, and he will find they fall exactly as far as they should do, on supposition that their inertia is neither increased nor diminished by gravitation. The method of making the calculation, a demonstration of which is given in mechanics, is the following—Multiply the number of feet which a planet moves in its orbit in one second of time, by itself, and divide the product by the diameter, in feet, and the quotient will be the number of feet which the planet deviates from a tangent in a second. It will be found, by calculating according to this rule, that the deviations from the tangents of the orbits of all the planets are inversely as the square of their distances from the sun. Now if Mr. Bakewell's doctrine is true that inertia is always in proportion to gravitation, these deviations from the tangents should be equal in all the planets in equal times. For he says, "if we suppose

the attraction of the earth should be increased a hundred fold, the velocity of a ball, falling sixteen feet, would not be increased or changed, because the inertia, or impeding power, would also be increased at the same rate, and therefore under every degree of gravitating force, or whatever may be the quantities of matter contained in the bodies acted upon by it, the velocity with which they obey it is as the rule for falling bodies near the earth, sixteen feet the first second," &c.

Again he says, "if the earth were divested of the motion in its orbit round the sun, and, consequently, of its centrifugal force, it would fall to that body under the same law, and commence its career at the same rate, that an apple falls from a tree, viz. sixteen feet the first second," &c. For the sake of testing the correctness of this opinion, as well as illustrating the rule given above, let us actually calculate how far the earth deviates from a tangent to its orbit in one second of time; for this is the exact distance it would fall towards the sun in one second, if its projectile force were destroyed. Suppose its distance to be ninety-six millions of miles, its orbit then will be 3.1416 times twice 96,000,000=603187200 miles nearly. This multiplied by 5280, the number of feet in a mile, gives 3184828416000, the number of feet in the earth's orbit. This number again being divided by 31557600, the number of seconds in a year, gives 100921 feet, nearly, for the distance the earth moves in her orbit, in one second of time. The square of this last number, that is, the number multiplied by itself, is 10185148241, and this divided by 1013760000000, the number of feet in the diameter of the earth's orbit, gives .01004 feet, the distance which the earth would fall towards the sun in one second, if her projectile motion were destroyed. That is, she would fall but little more than one-ninth of an inch, instead of sixteen feet.

By calculating in a similar manner the distance which Herschell falls from the tangent of his orbit in a second, by the force of the sun's attraction, it will be found to be nearly 361 times less than that of the earth, for Herschell is nearly nineteen times further from the sun than the earth, and 19 times 19 is 361.

Mr. Bakewell says, "a friend of mine thinks that the tides make against my theory; for if the waters on the earth are at all influenced by the moon's attraction, they ought to fall to it at once."

I agree with this friend, and I think if Mr. Bakewell examines again what he has written in answer to this objection, he will find he has said nothing to show the possibility of there being a tide on the opposite side of the earth from the moon.

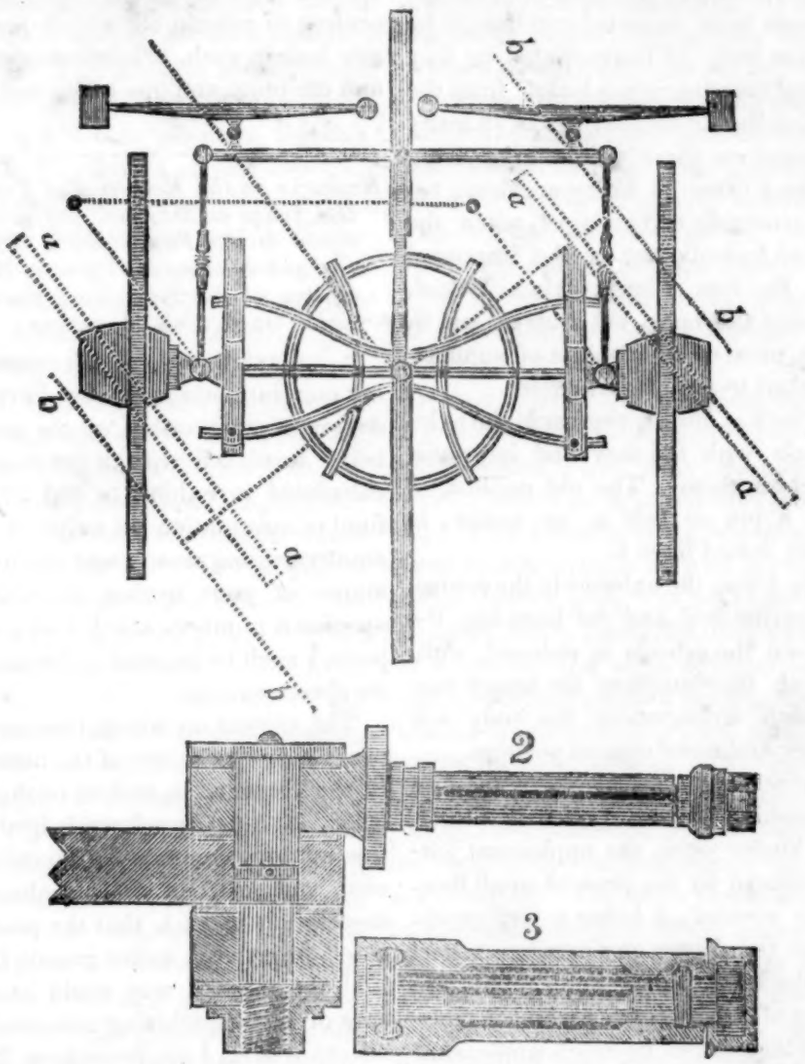
Indeed, some of the consequences of Mr. Bakewell's hypothesis are so evidently absurd, that I cannot imagine how it could have been entertained for a moment by a gentleman who, in some of his subsequent essays, manifested a very acute mind.

For example: If there were only two bodies in the universe, one indefinitely large, the other indefinitely small; for instance, the sun and a grain of sand; by this hypothesis they would fall towards each other with equal velocities, and would move the same distance the first second, when placed one thousand millions of miles apart, as if they were separated only one hundred yards.

According to Kepler's law, which is not hypothetical, but derived from patient observation, the squares of the periodic times of all the planets round the sun are as the cubes of their distances: according to Mr. Bakewell's hypothesis, the periodic times would be as the square roots of the distances. Again, from Kepler's law it is known that the velocities of the planets in their orbits are inversely as the square roots of their distances: whereas, by Mr. Bakewell's hypothesis the velocities would be directly as the square roots of their distances. Let us take one example. Suppose a planet four times as far from the sun as the earth, and suppose, according to the hypothesis, it falls from a tangent to its orbit, the same distance as the earth falls, it may be shown by geometry that it must move twice as far in its orbit to be the same distance from the tangent as the earth is, in the same time, which moves in a circle four times less.

In like manner it may be shown that if a planet is nine times as far from the sun as the earth is, it will have to move three times as far in its orbit, to be removed the same distance from the tangent, at the end of a second, as the earth is. Now, according to the law which actually exists in nature, the earth moves three times as fast as a planet which is nine times as far from the sun as itself: whereas, according to the hypothetical law we are examining, the planet would move three times as fast as the earth.

If this article should be successful in freeing an active and ingenious mind from the trammels of a false hypothesis, on a subject of high importance, it will not have been written in vain.



[*From the London Mechanics' Magazine.*]

MASON'S PATENT IMPROVEMENTS IN LOCKING THE FORE WHEELS OF FOUR-WHEEL CARRIAGES. *Communicated by the Inventor.*—It has long been acknowledged, that the present mode of locking the fore wheels of four-wheeled carriages from the centre is very unsafe, and many times the cause of serious accidents. This arises from both the fore wheels being fixed or mounted to the same axletree; the consequence is, that when wheels so attached are locked, the fore wheels form little more than three bearings or points of support, from which circumstance four wheel carriages are very liable to be overturned. Another great inconvenience is produced by the fore wheels so attached to the axletree being of necessity made much smaller than the hinder ones, causing thereby a very great increase in the draught; and if such wheels are increased in diameter, it can only be by allowing the body of the carriage to be placed much higher, which makes it both unsafe for use and inelegant in appearance.

In W. Mason's patent improvements on four-wheel carriages, the fore wheels may be made very nearly or quite as large as the hinder ones, thereby reducing the draught in a very considerable degree, and giving greater ease to those who travel in such vehicles, for it must be evident, that the smaller the wheels are, the more likely they are to fall into the inequalities found in the surfaces of roads, and thereby to cause jolting and very unpleasant motion; but in the improved mode herein submitted, these inconveniences are avoided, and the body of the carriage is also hung much lower, and in consequence it is more convenient to enter in and get out of; the appearance in point of elegance, is also much improved.

The principal advantages arising from the improvements herein submitted are as follow:

Firstly, instead of both fore wheels being mounted upon one axletree as usual, each wheel is mounted on an arm, which arm is joined to the end of the fixed axletree, by which means each wheel locks so near its own centre, that

a 3 feet 6 inch wheel will only run back one inch and a half when locked to the utmost extent required. Wheels thus mounted can never be placed under the body of the carriage, as they are in the usual manner, when locked from the centre, by which means the carriage is, in many instances, placed on three points of bearing only, from which cause so many accidents occur by the overturning of carriages, when the fore wheels are locked; but in the improved construction, the fore wheels when locked, never pass under the body, but always, and in every position, present four points of support, even when locked to the utmost extent.

The dotted lines *a*, Fig. 1, represent the axletree and wheels, with the new and improved method of locking them. The old method, of turning upon a pin or bolt in its centre, is shown by other dotted lines *b*.

Secondly, by fixing the axletree in the centre, between the spring-bed and the horn-bar, the distance between the wheels is reduced, without diminishing the length of the upper carriage; by which arrangement the body will hang in a better and more elegant position.

Thirdly, by increasing the height of the fore wheels, and making them very nearly the diameter of the hinder ones, the unpleasant jolting that is produced by the present small fore-wheels will be avoided; it being a well established fact that the larger any carriage wheel can be made, the less will it be liable to fall into the inequalities of the roads over which it passes, and from which cause so much unpleasant motion is produced. To this advantage may be likewise added the great reduction in the draught; which, with wheels so nearly equal in diameter, will be little more than half what it is in the old construction, while the beauty of a carriage constructed in this improved manner will be greatly increased; small fore wheels at all times producing a vacant appearance when viewed externally.

Fourthly, by fixing the swinging bars on joints, the draught of the horses are equalised in any position; and in turning, each is always kept tight.

Fifthly, these improvements can be applied to any four wheel carriage without altering the hind part.

New contrivances for oiling the wheels and joints are also introduced, by which means carriages will run many thousand miles without oiling. These will be sufficiently understood by references to Figs. 2 and 3.

Fig. 2 is an elevation and section of one of the improved arms and joints by which it is connected with the axletree.

Fig. 3, section of the improved box. Both the arm and the joints have cavities in their centres to contain oil, which passes through a side hole in each, to lubricate the box, the arm, and the joint, and one oiling will last for years.

W. M.

Remarks on the Economy of Peat as Fuel, and the Ashes as Manure, particularly in Reference to the Poor. By T. Bridgeman, Florist and Seedsman. To the Editor and Proprietor of the New-York Farmer and American Gardener's Magazine:

Gentlemen,—I am constrained to offer my congratulations to the Farmers and Gardeners of our country, on the prospect of their being furnished with a periodical publication calculated to exhibit to the attentive reader a fund of information on subjects which are constantly gaining proselytes; and from the circumstance of your having introduced into your specimen number, articles on a variety of subjects, I shall be induced to become a more regular correspondent.

The subject on which I am about to treat appears to me to be one of the utmost importance to the Farmer, as well as to the community at large. It must be acknowledged, that although this country contains an abundance of wood, coal, and peat, as well as almost every other description of fuel, that the poor of our large cities, in general, suffer greatly from cold; and if all the tales of woe could be sounded in the ears of a sympathizing community during our severe winter, I am persuaded it would arouse them to the consideration of a remedy. It is an acknowledged fact, that the poor of Europe are cheaper and better supplied with fuel than those of this country. This arises in a great measure from the circumstance of ashes being held in high estimation by Agriculturists; they are consequently a saleable article in their large towns and cities, at a price equal in some instances to half the cost of a winter's fuel.

In the third edition of a book I published last Spring, entitled "The Young Gardener's Assistant," I endeavored to stimulate the public to a consideration of this subject; and being convinced of its importance, I beg leave to introduce the following paragraph from page 178 of that work, as being calculated to exhibit the subject in its most important bearings.

"Although our limits will not allow of a further description of the various sorts of insects which injure our gardens, and frequently destroy the first fruits of our labor, I cannot forbear directing the attention of our citizens to the importance of saving all kinds of ashes. If all agriculturists and horticulturists were to offer

an inducement to the inhabitants of large cities to save their ashes, *in a dry state*, they would be supplied not only with a valuable manure, but an antidote for many kinds of insects; and our citizens would be at less risk from fire, by having a brick vault on the premises for safe keeping them. In England, a private dwelling is not considered complete without an ash vault, and a good farmer would dispense with his barn, rather than be destitute of an ash-house. I have known farmers supply the cottagers with as much peat as they could burn, on condition of their saving them the ashes; and there are some that will keep men under pay throughout the year, burning peat for the same purpose; and any thing that has passed the fire is so valuable, that a chimney-sweep will frequently clean chimneys for the sake of the soot, which is conveyed miles into the country, and sold at a price sufficient to reward the collector, besides paying all expenses; even the house-keeper's ashes in cities is a marketable article at all times, at from ten to twenty-five cents per bushel, *when kept dry and clean*, and a guinea a load (equal to $5) was formerly the common price in the villages of Berkshire and Hampshire."

Now I would ask, how it is that ashes are not as valuable to the farmers here, as they are in Europe. The extreme heat of the summers must certainly engender insects in equal if not greater proportions; and as respects manure, it must be scarcer in some parts of this extensive country, than it is in the dense populated countries of Europe. Perhaps some may answer that ashes are already used by our cultivators to a considerable extent; but I would remind such, that from the circumstance of their being mixed up with other manures and exposed to all sorts of weather, (as in our city,) they lose their virtue, so that a load may not be worth more than a bushel would be, *if kept dry and clean*. The farmers of Europe consider peat ashes of more value than any others, and I am persuaded that could they be fairly tested by some of our best cultivators, great good may result to the community. If the farmers of England can afford to keep men under pay, perpetually burning peat for the sake of the ashes, it is natural to suppose that the poor of our community may be placed in easier circumstances as respects the article of fuel. Thousands of acres of land are to be found in the States of New-York and New-Jersey, and within a few miles of this city, which abound with peat earth; and the owners of such have already began to explore their treasures of this description. Good peat is now to be had in the city at the low price of eight cents per bushel, or three dollars per chaldron. It burns well in all sorts of stoves, and grates, whether made for wood or coal, and also on the hearth; and if the ashes are not used to any better purpose than other ashes have hitherto been, it is the cheapest fuel known. I am persuaded that this subject is worthy of serious consideration, and if the editors of the different papers would arouse the public attention so as to enlist some of our most active citizens to a consideration of the subject, incalculable good may result to the community at large.

If the honourable the Corporation of our city, and others who distribute fuel amongst the poor, gratis, would give them peat instead of wood, it would be much cheaper, and would answer every purpose to the consumers. In such cases twelve bushels may be given in the first winter month to each of the applicants, instead of wood, with a strict injunction that they save the ashes in a dry state, in order to their being taken in exchange for a future supply of peat. It could easily be ascertained how much ashes twelve bushels of peat would make, and if a strict attention be paid to the conditions of exchange, it would soon be discovered which of the applicants was most entitled to the distributor's bounty. The same sheds which it would be necessary to provide for housing the peat, could be used as a deposit for the ashes.—If such sheds be conveniently constructed to hold each a moderate quantity, the first which is emptied of peat may be filled with the first ashes that are returned in exchange for a future supply of fuel, and they could be all used for the same purpose as they become empty. These ashes when fairly tested, may become a merchantable article, as in Europe; and it is very probable that farmers may be induced to take them in exchange for future supplies of peat; they could, however, be conveyed into the country at a trifling expense, and would no doubt meet a ready sale.

I am persuaded, Mr. Editor, if you should succeed in arousing the public to a consideration of this important subject, that your periodical will be viewed as a public blessing; which, like railroads and canals, open channels calculated to extend our intercourse, and thereby promote the general interest and happiness of the inhabitants of this highly favored country.

Yours, most respectfully,

THOMAS BRIDGEMAN.

Bowery Road, December, 1832.

THE LACE BARK TREE (Lagetta lintearia) grows in the high rocky hills of Jamaica, to the

height of 20 feet; the bark is thick, and may be separated into 20 or 30 laminæ, white and fine like gauze; of this caps, ruffles, and even whole ladies' suits of clothes, have been made.

[*From the Miner's Journal.*]

COAL TRADE.—We have laid before the public some statistical information respecting certain branches of the Coal trade, including a view of the capital invested and labor employed in the business of mining and transporting to market the amount of the annual exportations of this mineral from this region. We have not entered into any calculation relative to the cost or value of the very expensive improvements incident to mining establishments. Neither have we said any thing concerning the lands themselves, whence our supplies are derived. The whole number of miners, laborers, horses, cars and boats employed, together with the respective wages of the two first, and original cost of the latter, is comprehended in our statement, without any reference to other collateral subjects which might be introduced. The amount of coal exported from this region during the season which is just ended, is equal to two hundred and four thousand tons. If sufficient encouragement by early purchases is afforded to the industry of the miner and laborer, this quantity may be indefinitely increased, in a ratio at least equal to any future demands. No one in any degree acquainted with the extensive resources of this region will for a moment question the truth of this proposition. The natural capacity of our mountains to supply the article is literally boundless—the means of exportation adequate—the industry of our population greater than any requisitions that can be made upon it. An example afforded by a single locality will illustrate our meaning. On the West Branch rail-road there are 325 cars, belonging to thirty colliers. Contracts have been already made for supplying 100 additional cars. Without including other cars than those which are already on hand or positively engaged, we will commence our calculation by stating that each car will carry two and a half tons of coal. Allowing only one trip per day, while many very frequently make two, the sum total would equal 1000 tons per day, or 6000 tons per week. Estimating a period of 30 weeks for active operations during the season, the aggregate quantity would amount to 180,000 tons, almost thrice as much as is required for the annual supply of New-York. This is a very moderate statement of what can actually be accomplished by one-third of the coal region. Should the backwardness of purchasers and contractors suffer a considerable portion of the season for active operations to elapse without making provision, our calculation may be verified—but the fault will not be ours.

Of the above mentioned 204,000 tons of the coal shipped from this region, there passed down the West Branch railroad - 67,059
Mount Carbon, - - - 57,234
Schuylkill Valley, - - - 27,981*
Mill Creek, about - - - 30,300

Total - - - - - 182,574

The balance of the 204,000 tons was mined on the line of the canal in this vicinity.

One miner can mine 1½ tons of coal per day—say that he works 5 days in the week, and 45 weeks in the year, this will make 225 days; to mine 203,000 tons of coal will require in round numbers 600 miners. It will require as many persons to haul out, screen, and convey the coal to the landings, making openings, &c. as it does to mine the Coal—therefore say 600 laborers.

The West Branch railroad is about 12 miles long—the average distance of hauling thereon about - - - - 9 miles
Mount Carbon railroad 4 miles, do do 3 do
Mill Creek railroad 4 miles, do do 3 do
Schuylkill Valley do 10 miles do do 5 do
—20

Average distance (say 5 miles)—one horse hauls 4 wagons, and makes two trips per day—each wagon averaging 1¾ tons—will make 14 tons for each horse per day—multiplied by 225 days, gives 3150 tons to each horse—which divided into 203,000, gives 65 horses. It requires an equal number of horses to haul the coal out of the drifts—say 130 horses.

To carry this Coal to market it requires about 400 boats—400 horses—and two men and one boy to each boat—making 1200 men and boys on the line of the canal. Total, 2400 persons and 530 horses actually engaged in mining the above coal and conveying it to market.

There are on the West Branch Railroad in use 325 cars, Mount Carbon 150, Mill Creek about 200, Schuylkill Valley 230—total 905 cars.

The cars on the West Branch and Mount Carbon railroads cost on an average $90 a piece—and those on the Mill Creek and Schuylkill Valley cost about $50 a piece—which would amount to - - - - $64,550
400 boats at $500 each - - 200,000
530 horses at $40 each - - 21,200

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*There also passed down this road 33,470 shingles and 628,092 feet of boards.

600 miners at $7 each per week -	189,000
600 laborers at $6 do do -	162,000
1200 boatmen at $5 do for 32 weeks	192,000
Active capital - - -	$828,750

RECAPITULATION.

Miners - - - - -	600
Laborers and boatmen - -	1800
Total - - - -	2400
Horses - - - - -	530
Cars - - - - -	905
Boats - - - - -	400
Active capital - -	$828,750

Price of Fuel in New-York, Dec. 18, 1832.

COAL.

	Cargo.	Retail.
Liverpool, per chaldron, -	$11 50	$13 50
Sydney do - -	9 50	10 50
Virginia do - -	9 00	10 00
Schuylkill, per ton - -	9 50	11 00
Lehigh do - -	9 50	11 00
Lackawanna, do - -	9 50	10 00

WOOD.

Hickory, per load, ($\frac{1}{2}$ cord) -	$2 50 *a* 3 00
Oak do - - -	2 00 *a* 2 25
Ash do - - -	2 00 *a* 2 25
Pine do - - -	1 50 *a* 2 00
Chesnut do - - -	1 37 *a* 1 50

The following is the quantity of Coal sent to market in the years 1831 and 1832, as near as can be ascertained, in round numbers;

	1831.	1832.
Schuylkill -	81,000 tons	204,000
Little Schuylkill -		14,000
Lehigh - -	43,000	76,000
Lackawanna -	53,000	85,000
	177,000	379,000
The consumption last year, as near as can be ascertained, was		227,000
		152,000

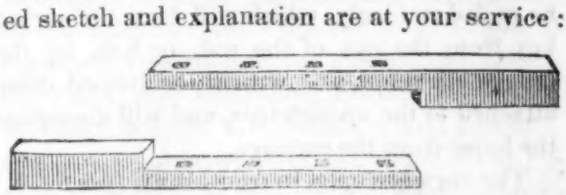
Showing an increase over the consumption of last year of 152,000 tons, and over the supply of the same year of 202,000 tons.

Advantages and Durability of Wrought Iron Ploughs. By B. To the Editor of the New-York Farmer, and American Gardener's Magazine.

Sir—Loudon tells us, in his Magazine for October, that these ploughs have in Scotland almost everywhere been substituted for wooden ones; and the saving is considered great, on account of their extreme durability. They have been introduced twenty-six years, and there is not an instance of one of them being worn out. I have had one in use two years, and think I studied economy, although I paid for it $28. The draft is about the same as that of an ordinary wooden plough, and its work equal to the best, particularly on a sod. It has an almost indispensable appendage, too seldom seen to wooden ploughs—what is technically termed a *bridle*, by which the depth and width of the furrow slice is graduated at pleasure.—Every farmer appreciates the importance of a plough running flat, or, in other words, of pitching neither upon the point or heel, when at work; yet few are aware, that a knowledge of a simple principle of mechanics will enable them readily to adjust it, in this respect, principally by means of a well constructed bridle. The *line of traction* is that which passes from the *point of draft*, or that point of the yoke or collar to which the chain and traces are affixed, when the cattle are exerting their power, to the *point of resistance*, that is, the point of the stock or share. This should be a straight line, *passing through the bridle*. If the bridle, to which the chain or whiffle-tree is attached, is above this line, the end of the beam is necessarily depressed, and the plough runs upon the point or sock; and if it is below, the same tendency is exerted to throw the plough upon the heel. But as I sat down merely to recommend iron ploughs, and not to lecture upon agricultural mechanism, I will only add Mr. Editor, that you may find, upon this latter subject, much to interest your readers in Wil liamson's treatise on agricultural machinery and implements. B.

Expeditious Mode of making Posts for Fences. By [?] To the Editor of the New-York Farmer and American Gardener's Magazine.

Sir,—If an economical and expeditious mode of making posts for fences would be a desideratum to any of your readers, the annexed sketch and explanation are at your service:



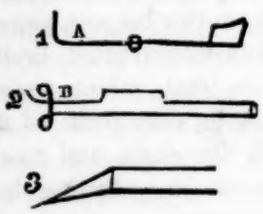
It almost explains itself. After you have hewn your post *entire*, which must obviously be from eighteen inches to two feet longer than is required for a single one, saw it half through, at equal distances from each end, but on opposite sides; then split it down the middle, and you have two good posts with a little more than the trouble of one. For post and rail fences, mortice it first, and proceed in the same way.

[?]

[*From the Journal of the Franklin Institute.*]

Specification of a patent for a mode of detaching horses from a carriage, either when running away, or whenever it may be desirable to effect that object rapidly. Granted to ROBERT BEALE, *City of Washington, District of Columbia, May* 12, 1832.

Be it known, that I, Robert Beale, of the City of Washington, in the District of Columbia, have made an improvement in carriages, by which the horses may be suddenly disengaged when running away, or whenever required to be detached from the carriage quickly; called the safety carriage; which is described as follows:



The swingletree is attached to the cross bar by an iron fixture called a jointed clasp, formed as in the annexed figure, (see figure 1); the knee part, marked A, resting against the back of the cross bar. This jointed clasp is held up against the underside of the cross bar by an iron shutter, or hinged clasp, formed thus, (see figure 2,) turning on a joint, or hinge, secured to the underside of the cross bar. To the end of the hinged clasp is attached an iron rod, or bolt, B, with an eye at its end. This rod, or bolt, passes through an opening in the cross bar, and has an iron spring key inserted through the eye, resting on the upper side of the bar, which secures the jointed clasp from dropping; or the rod may be fixed permanently to the cross bar, projecting far enough below it to pass through a slot or mortice in the end of the hinged clasp, with a spring key inserted through the end of the rod, or bolt, to prevent the hinged clasp falling. To the end of the spring key is attached a cord which leads inside of the carriage, where it hangs loosely. Should the horse take fright, and become unmanageable, the cord is then to be pulled suddenly, which will draw the spring key from the eye of the rod, or bolt, let the hinged clasp fall, and with it the jointed clasp attached to the swingletree, and will disengage the horse from the carriage.

The tugs are open in front, thus, (see fig. 3,) to allow the breeching to slip off freely. This breeching is made from a single strap of leather, with rings sewed to the ends, to hook over the tugs.

The shutter, or hinged clasp, may have its end turned up at right angles, and formed like a catch, or hook, and secured by a spring, fastened to the side of the cross bar, the cords being attached to the end of the spring. The shutter may, indeed, be held up in a great variety of modes, but the before described are sufficient to show the principles of my invention.

When it is desired to retain the swingletree, and let the horse go off with traces only, a hinged clasp must be put on each end of the swingletree, with the jointed clasps secured to the end of the traces, and the cords attached to the spring keys run through pulleys and are joined to the cord which leads inside of the carriage.

In the two-horse carriage, the shutters, on hinged clasps, are hung on the under side of the whippletree, and the cords attached to the spring keys run along on the top of the whippletree in a straight line, then pass around pulleys, and are joined to the single cord which leads inside, or outside, of the carriage. The pulleys are to cause the cords to run freely, and to draw the spring keys, or pins, from the eyes of the rods, or bolts, in a straight line.

An iron tube, with a flaunch on one end, is fastened to the end of the pole. Over this is put a thimble, having a ring on each side, to which the breast straps are attached. This thimble slips off the end of the pole, when the horses are disengaged.

The mode of detaching the horses from the two-horse carriage is similar to that described for a single horse carriage.

In a four-horse carriage the leaders are disengaged from the pole in the same manner, by a jointed clasp, hinged clasp, spring key, and cord, as described for a two-horse carriage. The jointed clasp may be held up against the cross bar by a pin inserted through the jointed clasp into the hind part of the cross bar, to which pin the cord is attached.

The jointed clasp may also be secured by a spring fastened on the hind part of the cross bar, the cord being attached to the end of the spring. Springs, or friction levers, are secured to the carriage, brought in contact with the hub in order to decrease the motion of the carriage when the horses are liberated, or before they are liberated.

This invention may be applied to field artillery, and it will enable the men to limber or unlimber the gun in less than half a minute. It may also be applied to wagons of every description, to ploughs, and harrows, and all kinds of agricultural implements drawn by horses, when required to be taken in haste from the carriage to feed, &c.

A forked piece of iron is suspended over the hound and front axletree to prevent its turning on the body bolt.

What I claim as my invention, and which I wish to secure by *letters patent*, is the before

described apparatus for suddenly disengaging horses from carriages.

For a further illustration of my invention I would refer to the models and drawings of the same deposited in the patent office.

ROBERT BEALE.

[*From the American Railroad Journal and Advocate of Internal Improvements.*]

ELECTRICAL TELEGRAPH.—The following communication was handed to us by an intelligent foreigner, now in this city, relative to the transmission of intelligence between commercial cities, as New-York and Albany, or New-York and Philadelphia—for instance, by means of Electricity. He has also explained to us his proposed plan of communicating or receiving intelligence between any two given points, however distant, almost instantaneously. The *principle* is by no means new; but the *application* of it to this important purpose has not been, that we are aware of, attempted by any person before. The inventor, Mr. Borch, of St. Croix, —who has, as he informs us, secured a patent for his invention,—thinks it may be applied with great ease to long lines of Railroad.

To the Editor of the American Railroad Journal:

SIR,—On the principle that the electric fluid can, by the means of an insulated conductor, be conveyed to any distance instantaneously, and that where there is any small opening in the conductor a spark will appear, which principle has been proved or established by numberless experiments. I have discovered a mode by which an instantaneous and reciprocal communicator of any intelligence from one place to another, at any distance, may be made. G. V. BORCH.

P. S. This communicator might especially be of great use in railroads.

New Gun introduced into England by M. JACQUES AUGUSTE DEMONDION. [From the London Mechanics' Magazine.]

The gun is loaded and primed at one operation, and is cocked by lifting up the breech to introduce the cartridge.

The cartridge is of a peculiar kind; containing within itself a tube filled with detonating powder, which, exploding in the very middle of the cartridge, produces a better discharge. It requires a third less powder than common cartridges, and the bore of the gun is greater at the breech than at the muzzle, which makes it carry farther and more correctly.

From the peculiarities of the cartridges and barrel, the cartridges taken from the enemy can be immediately used with the new gun, but the new cartridges will not do for the pieces of the enemy.

The bayonet is more easily managed in exercising; is more difficult to be pulled off by an enemy; is longer, and the shoulder shorter than usual; therefore it is stronger; and being underneath the gun instead of at the side, is more dangerous, and does not interfere with the aim: the charge is completely covered up and protected from wet.

The gun is so easily managed, that with a few hours practice a soldier will fire 10 to 19 shots a minute; and can load and fire upright or lying down—marching or standing—one almost as well as the other. From not having to use his arm to load, he is less liable to be wounded by the enemy's shot; and for the same reason, the gun is particularly advantageous on board of ship. Moreover it can be loaded easily in the dark.

And although more shots are fired in a minute, the barrel does not heat so much as those of common guns, because at every shot there is a rush of air through it.

It is very strong, cannot be inadvertently double-loaded, and is free from many of the disadvantages of flint or percussion lock guns.

It is simple, and can be made by common workmen, and all its parts are of regular shape, so that they can be made by machinery, which will reduce its expense below that of ordinary guns.

It is easily cleaned, having neither cocks nor any complicated system of springs; and the ring that holds the bayonet on, has a screw-driver on it to unscrew the parts.

TANNING.—The Salem (Mass.) Gazette mentions that Mr. K. Osborn, of Danvers, has made an improvement in tanning, and discovered a new article for fuel. He has recently put in operation a steam mill, for grinding bark, beating hides, and smoothing leather. The only fuel used is spent bark or tan, which has hitherto in tan-yards been of no value. The engine, mills, and appurtenances, cost about two thousand dollars, and are equal to a grist-mill power. Tan has been long used in families in that vicinity as fuel, but its value has never before been fully tested. Its use at this mill proves a chord of it to be worth as much as a chord of white pine wood; one chord will grind six chords of bark; and that, with stoves and grates properly constructed, houses may be warmed, and all the cooking in families performed with no other fuel at a trifling expense.

The following able, yet not more able than true, exposition of the advantages of Railroads, is from the *Edinburgh Review*. It is but a plain statement of facts, yet they are so *clearly* and *forcibly* stated, that they can hardly fail to convince those who still doubt the truths therein set forth. We should be gratified to see them extensively copied.

"RAILWAYS.—Railways are in progress between the points of greatest intercourse in the United Kingdoms, and travelling steam engines are in preparation in every quarter for the common turnpike roads; the practicability and utility of that application of the steam engine having not only been established by experiment to the satisfaction of their projectors, but proved before the legislature so conclusively, as to be taken for the foundation of parliamentary enactments.

"The important commercial and political effects attending such increased facility and speed in the transport of persons and goods, are too obvious to require any very extended notice here. A part of the price (and in many cases a considerable part) of every article of necessity or luxury, consists of the cost of transporting it from the producer to the consumer; and consequently every abatement or saving in this cost must produce a corresponding reduction in the price of every article transported; that is to say, of every thing which is necessary for the subsistence of the poor, or for the enjoyment of the rich, of every comfort, and of every luxury of life. The benefit of this will extend, not to the consumer only, but to the producer; by lowering the expense of transport of the producer, whether of the soil or of the loom, a less quantity of that produce will be spent in bringing the remainder to market, and consequently a greater surplus will reward the labor of the producer. The benefit of this will be felt even more by the agriculturist than by the manufacturer; because the proportional cost of transport of the produce of the soil is greater than that of the manufactures. If 200 quarters of corn be necessary to raise 400, and 100 more be required to bring the 400 to market, then the net surplus will be 100. But if by the use of steam carriages the same quantity can be brought to market with an expenditure of 50 quarters, then the net surplus will be increased from 100 to 150 quarters; and either the profit of the farmer or the rent of the landlord must be increased by the same amount.

"But the agriculturist would not merely be benefitted by an increased return from the soil already under cultivation. Any reduction in the cost of transporting the produce to market would call into cultivation tracts of inferior fertility, the returns from which would not at present repay the cost of cultivation and transport. Thus land would become productive which is now waste, and an effect would be produced equivalent to adding so much fertile soil to the present extent of the country. It is well known that land of a given degree of fertility will yield increased produce by the increased application of capital and labor. By a reduction in the cost of transport, a saving will be made which may enable the agriculturist to apply to tracts already under cultivation the capital thus saved, and thereby increase their actual production. Not only, therefore, would such an effect be attended with an increased extent of cultivated land, but also with an increased degree of cultivation in that which is already productive.

"It has been said that in Great Britain there are above a million of horses, engaged in various ways, in the transport of passengers and goods, and that to support each horse requires as land as much would upon an average support eight men. If this quantity of animal power were displaced by steam engines, and the means of transport drawn from the bowels of the earth, instead of being raised upon its surface, then, supposing the above calculation correct, as much land would become available for the support of human beings as would suffice for an additional population of eight millions, or, what amounts to the same, would increase the means of support of the present population by about one-third of the present available means. The land which now supports horses for transport, would then support men, or produce corn for food.

"The objection that a quantity of land exists in the country capable of supporting horses alone, and that such land would be thrown out of cultivation, scarcely deserves notice here. The existence of any considerable quantity of such land is extremely doubtful. What is the soil that will feed a horse, and not feed oxen or sheep, or produce food for man? But even if it be admitted that there exists in the country a small portion of such land, that portion cannot exceed, nor indeed equal, what would be sufficient for the number of horses which must, after all, continue to be employed for the purpose of pleasure, and in a variety of cases where steam must necessarily be inapplicable. It is to be remembered also, that the displacing of horses in one extensive occupation, by diminishing their price, must necessarily increase the demand for them in others.

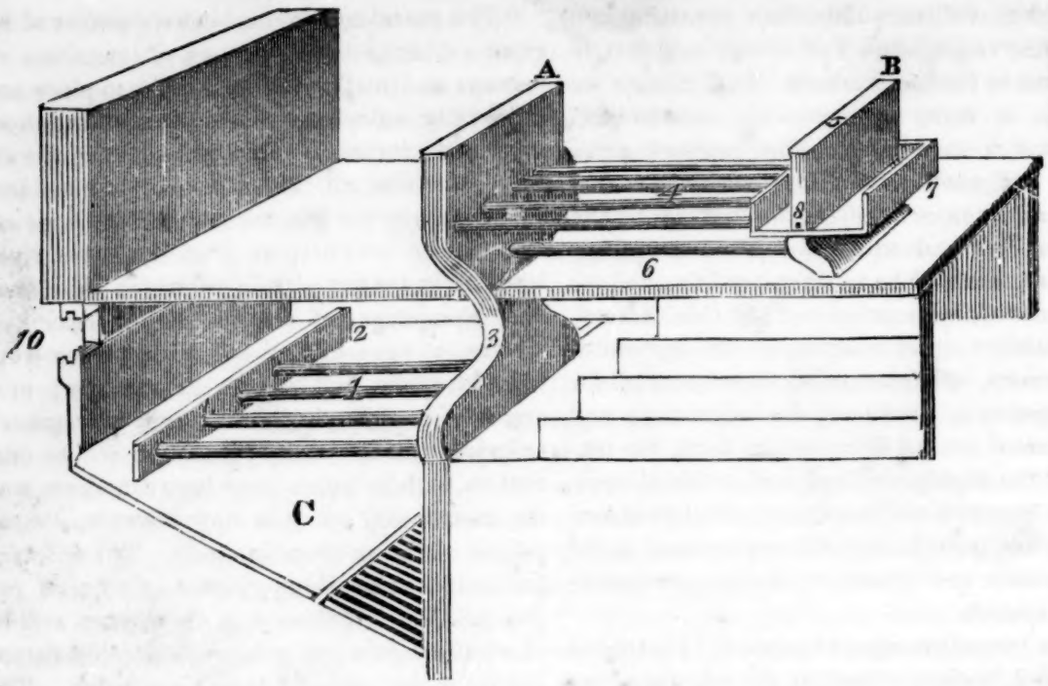
"The reduction in the cost of transport of manufactured articles, lowering their price in

the market, will stimulate their consumption. This observation applies of course not only to home but to foreign markets. In the latter we already, in many branches of manufacture, command a monopoly. The reduced price which we shall attain by cheapness and facility of transport, will still further extend and increase our advantages. The necessary consequences will be an increased demand for a manufacturing population; and this increased population again re-acting on the agricultural interests, will form an increased market for that species of produce. So interwoven and complicated are the fibres which form the texture of the highly-civilized and artificial community in which we live, that an effect produced on any one point is instantly transmitted to the most remote and apparently unconnected parts of the system.

"The two advantages of increased cheapness and speed, besides extending the amount of existing traffic, call into existence new objects of commercial intercourse. For the same reason that the reduced cost of transport, as we have shown, calls new soils into cultivation, it also calls into existence new markets for manufactured and agricultural produce. The great speed of transit, which has been proved to be practicable, must open a commerce between distant points in various articles, the nature of which does not permit them to be preserved so as to be fit for use beyond a certain time. Such are, for example, many species of vegetable and animal food, which at present are confined to markets at a very limited distance from the grower or feeder. The truth of this observation is manifested by the effects which have followed the intercourse by steam on the Irish Channel. The western towns of England have become markets for a prodigious quantity of Irish produce, which it had been previously impossible to export. If animal food be transported alive from the grower to the consumer, the distance of the market is limited by the power of the animal to travel, and the cost of its support on the road. It is only particular species of cattle which bear to be carried to market on common roads and by horse carriages. But the peculiar nature of a railway, the magnitude and weight of the loads which may be transported on it, and the prodigious speed which may be attained, render the transport of cattle of every species, to almost any distance, both easy and cheap. In process of time, when the railway system becomes extended, the metropolis and populous towns will therefore become markets, not as at present to districts within limited distances of them, but to the whole country.

"The moral and political consequences of so great a change in the powers of transition of persons and intelligence from place to place, are not easily calculated. The concentration of mind and exertion which a great metropolis always exhibits, will be extended in a considerable degree to the whole realm. The same effect will be produced as if all distances were lessened in the proportion in which the speed and cheapness of transit are increased.—Towns, at present removed some stages from the metropolis, will become its suburbs; others, now at a day's journey, will be removed to its immediate vicinity; business will be carried on with as much ease between them and the metropolis, as it is now between distant points of the metropolis itself. The ordinary habitations of various classes of citizens engaged in active business in the towns, will be at what are now regarded considerable distances from the places of their occupation. The salubrity of cities will thus be increased by superseding the necessity of heaping the inhabitants together, story upon story, in a confined space; and by enabling the town population to spread itself over a large extent of surface, without incurring the inconvenience of distance.—Let those who discard speculations like these as wild and improbable, recur to the state of public opinion at no remote period on the subject of steam navigation. Within the memory of persons who have not yet passed the meridian of life, the possibility of traversing by the steam engine the channels and seas that surround and intersect these islands, was regarded as the dream of enthusiasts. Nautical men and men of science rejected such speculations with equal incredulity, and with little less than scorn for the understanding of those who could for a moment entertain them. Yet we have witnessed steam engines traversing, not these channels and seas alone, but sweeping the face of the waters round every coast in Europe, and even ploughing the great oceans of the world. If steam be not used as the only means of connecting the most distant habitable points of our planet, it is not because it is inadequate to the accomplishment of that end, but because local and accidental causes limit the supply of that material from which at the present moment it derives its powers."

Hot Air Blast.—It is stated that the weekly consumption of coals at the Clyde Iron Works has been reduced, by the adoption of the heated blast, from 1800 to 600 tons; while, at the same time, a greater quantity of iron has been manufactured.



Heating Green-Houses and Dwellings by Hot Water. By Mr. M. Saul, Florist. To the Editor of the New-York Farmer.

Sir,—I herewith send you my plan for heating by hot water. To save time and room, I have sent part of the London Mechanics' Magazine, which was published May 19, so that you may select what part you think proper, and the above plan I have drawn expressly for your work, which will be of greater power than the one in the Mechanics' Magazine, or Gardeners' Magazine. Whether the hot water system is in use in America, I know not; but the following plan will well repay the expense. The fire-place is on the same principle as Witty's Improved Furnace in the Gardeners' Magazine, volume 7th, page 482. It is founded on the modern discoveries in chemistry, and forms so beautiful an instance of the application of scientific principle to the useful arts that I shall attempt to give your readers an idea of it. Coal, when dry, if submitted to distillation, or in other words exposed to greater heat, emits a large quantity of aqueous vapor and inflammable gas and becomes coke, which consists, when the coal is pure, almost entirely of carbonaceous matter. My fire-place is an inclined plane and terminated by a grate, and I also find that it is of no consequence whether the grate is fixed or moveable, like Witty's.

As the fire begins to burn at the lower end, and which is supported by air admitted through the grate, the coal, while it lies on the under surface of the inclined plane, and before it reaches the grate, undergoes a dry distillation, and the steam and gas which are thus expelled occupy the space above the coal. At the same time the coal which has already undergone this process, and in the shape of coke has reached the grate, is burning, and the air which passes through this coke fire, heats to a very high temperature, sweeps over the surface of the unburnt coal, or the inclined plane, and inflames all the gas as it is evolved. Thus the gaseous matters evolved from the coal are converted by combustion into gaseous vapors, thereby forming steam, and carried off through the flues, which are connected, diffusing heat wherever it is required without being accompanied with a single particle of smoke, which is a great advantage to hot-house plants. Wood might be burnt in this fire-place the same as coal.

My plan of increasing the heat by the same fire is on the same principle of a locomotive steam engine, which is, I have found to be, very great, having no boiler or cistern, but tubes in the fire, which is the reason our Liverpool railway carriages have such great power.

References.—1, the tubes, 21 inches long, $1\frac{1}{4}$ inches inside—these tubes put the water in motion as soon as the fire is kindled; 2, supports the tubes; 3, the conductor through the top of the flue; 4, the upper pipes for the hot water, which is carried forward with great power to 5, and returns through the pipe, 6, which is about 3 inches inside—the upper pipes are only 1 inch inside; 7, the reservoir, for supplying the waste—it supplies itself by a small aperture at 8—a loose plug is fixed so that the water gets in, and prevents the whole force of the hot water entering the reservoir, which would cause too great a steam in the house—by the stroke, as described in the other

plan, I have removed one end of the reservoir, to show the place where it supplies the pipes, at 8; I have removed the brick-work at the side of the fire to show the tubes; 10, there is a sliding door for feeding the fire, as described in the other plan; C is the fire-place, also described in the other plan; A B, to be considered as running all the length of the front flue.

You will not perhaps have seen in the Gardeners' Magazine a plan of a hot water cistern being fixed on the top of the flue; you will therefore select what part of this communication you think proper, as you will have observed in the last number of the Gardeners' Magazine a notice of Perkins' mode of heating by hot water, and I suppose you will have a description of it in the next number for June: so that you may judge for yourself. I wrote to Mr. Loudon to wish him to furnish me with the time it took in getting the water to the boiling point in Perkins' mode of heating, so that I might judge fairly of it, as I have got a drawing of Perkins' which appears to me not so good as Mr. Loudon thinks of it.

I remain, yours, &c. M. Saul.

Lancaster, England, May 29, 1832.

[*From the American Railroad Journal.*]

Foot Railroads.—Those inventions are the most important which enable all classes of society to make the best use of their personal strength. Railroads for the use of individuals, like a foot path, will do this. Stages, steamboats, and railroads for steam and horse carriage, will never do half the conveyance of passengers and goods over the country. Large railroads must necessarily be confined to great channels of communication: they require too great capital to be extended to every village.—It is stated that to move a weight of a ton on a level railroad requires but the strength that is requisite to raise up eight pounds over a pulley. To move 500 lbs. on a level railroad, would require then only the strength necessary to raise up 2 pounds over a pulley. Carriages of about the weight of a wheel-barrow, or less than fifty pounds, might be made for what I shall call a foot railroad. Probably the families that go to country stores do not carry generally more than 100 lbs. weight; and most commonly they do not carry more than 50 lbs. But suppose that it is 100; then there is a carriage of 50 and a load of 100 lbs. The force required to move this on a level railroad will be only a small fraction more than that required to raise half a pound over a pulley. And then there is a level path to walk on. If there are departures from a level, some more strength must be exerted at the ascending planes; but then the traveller can rest on his carriage at the descents. In fact, according to the principles of mechanics, as easily as a man of 140 pounds weight can travel up a hill 50 feet high, he can move forward a load of 280 pounds a mile and a quarter on a level railroad. It will appear then, that foot railroads will be a vast public benefit: an advantage not to the rich only, but chiefly to the laboring classes.

Publicola.

[*From Babbage's Economy of Machinery.*]

One of the most singular advantages we derive from machinery is in the check which it affords against the inattention, the idleness, or the knavery of human agents. Few occupations are more wearisome than counting a series of repetitions of the same fact; the number of paces we walk affords a tolerably good measure of distance passed over, but the value of this is much enhanced by possessing an instrument, the pedometer, which will count for us the number of steps we have made. A piece of mechanism of this kind is sometimes applied to count the number of turns made by the wheel of a carriage, and thus to indicate the distance travelled; an instrument similar in its object, but differing in its construction, has been used for counting the number of strokes made by a steam engine, and the number of coins struck in a press. One of the simplest instruments for counting any series of operations, was contrived by Mr. Donkin.*

Another instrument for registering is used in some establishments for calendering and embossing. Many hundred thousand yards of calicoes and stuffs pass weekly through these operations, and as the price paid for the process is small, the value of the time spent in measuring them would bear a considerable proportion to the profit. A machine has, therefore, been contrived for measuring and registering the length of the goods as they pass rapidly through the hands of the operator, and all chance of erroneous counting is thus avoided.

Perhaps the most useful contrivance of this kind is one for ascertaining the vigilance of a watchman. It is a piece of mechanism connected with a clock placed in an apartment to which the watchman has not access; but he is ordered to pull a string situated in a certain part of his round once in every hour. The instrument, aptly called a tell-tale, informs the owner whether the man has missed any, and what hours during the night.

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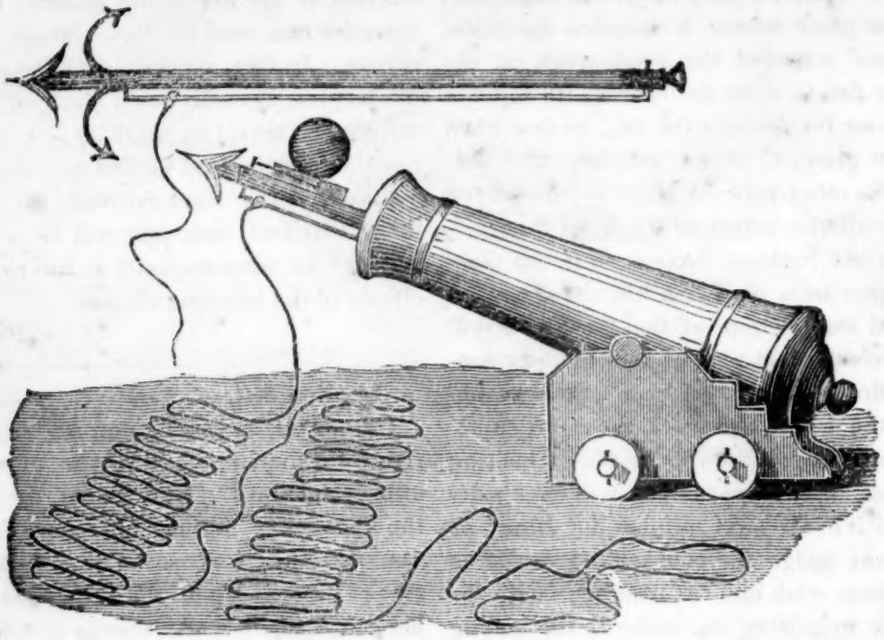
* See Transactions of the Society of Arts, 1819, p. 116.



[*From the London Mechanics' Magazine.*]

MR. MURRAY'S INVENTION FOR SAVING FROM SHIPWRECK.—Several ingenious methods have been proposed for effecting a safe communication between stranded ships and the shore. Mr. Trenghouse suggested a rocket, Capt. Dansey a kite, and Capt. Manby a shell, for the purpose of carrying out a line to the ship in distress. The plan of Captain Manby was thought so well of at first, that it was honored with a Parliamentary reward, and very great exertions have been made to introduce it into general use. But it has been found attended with so much difficulty, even under the most favorable circumstances, and has in not a few instances failed so decidedly, that it has been only very partially adopted, and has not effected any material diminution in the general loss of life by shipwreck. From the weight of Captain Manby's apparatus, it is not quickly transportable from the few stations which are provided with it, to the immediate scene of danger; and when the rope is projected it too frequently snaps in two. A transport was wrecked only three miles from Mundesley, where there was one of Captain Manby's safety-mortars, but before it could be conveyed to the spot the ship had gone to pieces, and all on board perished. In another case, of a ship wrecked off Whitby in 1820, within 60 yards of the shore, the shot, in the first attempt, fell short; the rope, in the second, broke; and the ship and crew were buried in the breakers. On many parts of the coast there is not even this imperfect apparatus of Captain Manby. So late as December, 1830, one of the most frequented, and, at the same time, most dangerous parts of the British coast —that between Plymouth and the Land's End —was so entirely destitute of every sort of means for saving shipwrecked mariners, that of the passengers and crews of 28 vessels which went on shore in the dreadful storm of that month, only two men and a boy were saved!

Frequent reflection on these distressing facts has led Mr. John Murray (the popular lecturer on chemistry, and the author of many excellent scientific works,) to the invention of the apparatus represented in the prefixed engravings, and described in the pamphlet which we have now before us.* Mr. Murray first tried to project from a common musket an arrow with a line attached to the feather end, but the arrow became *reversed* in its transit through the air, and the following improved and very ingenious arrangement was therefore adopted:—

"The highest figure represents the form of the arrow, as best constructed for the common blunderbuss, and may be propelled immediately from the shore, or carried with the life boat. The butt-end carries a thin metallic shield, or plate, which may be made of copper. The point is sharp and barbed, to fasten where it may strike, or act as a holdfast on the tackling or rigging of the wreck. It is shod with iron, as well to subserve this purpose as to secure its direction, and compete with the resistance it must encounter in a storm. The wood used is hickory, or ash, or, still better, lancewood, the more cohesive the fibre the better:

* Invention of an Effective and Unfoiling Method for forming an Instantaneous Communication with the Shore in Shipwreck; and Illuminating the Scene in the Dark and Tempestuous Night. By John Murray, F. S. A. &c. 30 pp. 8vo. Whittaker & Co.

this is withed in its extreme length with whip thread or line; bands or ribbons of thin metal strengthen the arrow, where the bent extremities of the parallel iron rod pass through, and which last are further secured by a shoulder on one side and a nut on the other. Along this parallel rod glances the iron ring to which the line is attached, the instant it leaves the gun, and a bit of cork, or caoutchouc, toward the end of the arrow, interposed between the rod and the body of the arrow, acting as a recoil spring, will so far subdue the effect of friction.

"The entire weight of the arrow, thus plumed and shod, is from two to three ounces, 18 inches long, and three quarters of an inch in diameter. These dimensions and weight have been found most efficient and successful when applied to a blunderbuss sixteen inches long in the barrel, and one and one-tenth inch diameter in the calibre. The entire weight of the arrow and its appendages, together with the strong whip-cord attached to it, was two pounds and one ounce, and ware carried to an extent of nearly one hundred yards by two drachms of gunpowder. The cord was of sufficient strength to pull a rope from the shore large enough to form a communicating medium of escape from the wreck.

"The lowest figure exhibits the arrow applied to a three pounder swivel, the calibre of which, however, though not represented in the plate, it ought nearly to fill. In this case, the arrow and its various adjustments weigh together nearly two pounds; and with three ounces of gunpowder a line of considerable strength and power will be propelled upwards of a hundred and fifty yards. In this instance a macharel, or deep sea-line, may be used. The cord is represented as coiled in the form of what is called French faking, and was the plan adopted in all our experiments, while it seems best adapted to preserve the coils from being entangled—a circumstance of the highest importance in experiments of this description. The barb is removed here to render the appearance less complicated.

"The arrangement is supplied with an appendage for illuminating the flight of the arrow and scene of shipwreck. It consists simply of a cylindrical sheath, or socket, containing the materials of illumination, consisting of a mixture of finely powdered chlorate of potassa and sugar-candy intimately blended together. A spindle supplied externally, with a flat head, enters by its extreme head into a miniature phial supplied with sulphuric acid, sealed with a drop of bees' wax. As soon as the arrow leaves the gun, the reaction of the air on the head of the spindle drives inward the plug of wax and liberates the acid, which instantly kindles the mixture, the brilliant flame immediately fills the globular cage of wire gauze which surmounts it, and the intensity of the light is rendered still more dazzling and splendid by adding a bit of phosphorus to the inflammable powder. This part of the apparatus is made altogether independent of the arrow, and may be easily attached when circumstances require it, as when the darkness of the night renders it imperative.—The combustion which forms the source of the illumination, cannot be quenched either by the sea spray or a deluge of rain, the medium of support being supplied from itself, altogether independent of the external atmosphere, however charged with watery vapour or rain, and the combustion is too fierce to be at all affected by the wind, even at its maximum degree of strength."

The "experiments" alluded to in the preceding extract are detailed more at length in a subsequent part of the pamphlet, and leave no doubt on our minds, that Mr. Murray's apparatus is by far the most efficient that has yet been devised; while, at the same time, it is so cheap and portable, that inclination alone is all that can be wanting to bring it into general use.

Ale from Mangel Wurtzell.—A writer in the New Monthly Magazine states, that from numerous experiments, he finds that an excellent ale may be brewed from this root in the proportion of fifteen pounds weight of it to the gallon of water, with the addition of two pounds weight of molasses, to the firkin. One third of malt and mangel wurtzel liquor will make a capital ale, so that even in this way a great saving might be effected. The method of brewing adopted by the writer is thus described: "First wash (or rather pare) off the outer rhine, slice and boil them until soft and pulpy, squeeze the liquor from the pulp as much as possible, and then boil it again with about six ounces of hops to nine gallons, and work with yeast in the usual way."

The leaves of the mangel wurtzell stripped from the plant in August or September are valuable food for the cow or pig, not retarding the growth of the plant in the least; the culture of the plant is very simple; the seeds should be placed on well manured ridges, eighteen inches apart, and six or eight inches between the plants; hoeing down and keeping them free from weeds.

[*From the American Railroad Journal.*]

The Treatise on Railroads written by Nicholas Wood, contains a table exhibiting the performance of certain locomotive engines, moving with different loads, aud upon planes of different inclinations. This subject is an interesting one to the practical engineer; and to the speculative mathematician it presents a problem for investigation.

The principal difficulty in estimating the performance of these Engines, is the uncertainty which seems to exist with respect to the amount of the loss of leverage under which the pressure of the steam in the cylinders must act, in communicating motion to the travelling or adhesion wheels. For with respect to steam engineers in general, a great source of loss in power arises from the oblique action of the connecting rods in communicating a rotary motion to the crank.

Some of the English engines, according to the above named treatise, are capable of exerting a motive force equal to 30 per cent. of the whole pressure of the steam upon the pistons. But it will appear from the following remarks, that an estimate of 30 per cent. much exceeds the truth. Indeed, as the effective pressure will vary with the length of stroke, and the diameter of the adhesion wheels and other things, it is impossible from any principles which would seem to have been contemplated by Mr. Wood, to make any just estimate of the effective pressure of the steam in engines differently constructed in those respects. The loss of effect, as far as the crank alone is connected, is susceptible of being determined by a strict mathematical investigation. For the object of inquiry will evidently be to ascertain what must be the value of a constant and uniform force, which, acting at the extremity of the crank, in the direction of its motion, will communicate the same momentum, in the time of one complete revolution, as is communicated by the variable pressure of the connecting rod, in the same time.

The differential and integral calculus renders this an inquiry of easy solution. I take the following notation: P= given force or pressure of the steam upon the piston; P' = pressure communicated from the piston to the connecting rod; P'' = pressure communicated from the connecting rod to the extremity of the crank, in the direction which produces a motion of rotation; P''' = effective pressure of the steam upon the crank, or an uniform pressure, required to act upon the extremity of the crank, in the direction of its motion, in order to generate the same momentum in a given time, as is generated in the same time by the variable pressure P''; k = length of the connecting rod; h = length of the stroke of the piston.

There are evidently two points in each revolution of the crank, which gives $P''=o$; and two other points *nearly* in the middle between the former, which gives P'' a *maximum*. Take therefore a circular arc z, to radius unity, containing the angle between the position of the crank at any time, and the remote point where $P''=o$.

The quantity of motion, communicated to the crank by the pressure P'' in an instant of time, is, agreeably to the principles of dynamics, represented by $P''\times dz$; and therefore the whole quantity of motion, communicated to the crank, in describing the arc z, will be represented by the integral of $P''\times dz$. But the whole quantity of motion which the constant pressure P''' would generate in describing the same arc, is in like manner represented by $P'''\times z$.

When therefore those two quantities of motion are made equal, the general expression is,

$$P''' = \frac{\text{Integral of } P''\times dz}{z}$$

Taking an arc A, whose sine is $\frac{h\sin z}{2k}$, it follows from the principles of mechanics, that $P' = P \times Cos.\ A$; and also, that $P'' = P' \times \sin(z - A)$. Hence,

$$P'' = P \times Cos.\ A \times \sin(z - A).$$

Substitute for *Cos.* A and *sin* A, their values; expand $\left\{4k^2 - h^2\ sin^2\ z\right\}^{\frac{1}{2}}$ into a series; and because $2k$ is always much greater than h, omit all quantities which contain $\frac{h}{2k}$ beyond the first power; multiply by dz, and integrate. The result, when $z = 180°$, is very nearly $P''' = \frac{2}{3}P$. And hence the following general

THEOREM:—A rotary motion being communicated to a crank, from the oscillations of the piston rods of a steam engine, by means of connecting rods much longer than the length of the crank: I say, the effective force upon the crank, during each complete revolution, abstracting from inertia and friction, is equivalent to a constant and uniform pressure of very nearly two-thirds of the whole force of the steam upon the piston rods, acting at the extremity of the crank, in the direction of its motion.

Having now found the effective pressure upon the crank, it is easy to determine what part of the whole force of the steam upon the pistons is communicated to the periphery of the adhesion wheels of the engine.

Let r be the radius of those wheels, and take E to represent the force communicated to the

peripheries thereof. The principle of virtual velocities, gives E : P‴ : : velocity of the extremity of the crank : velocity of the periphery of the adhesion wheels. But in uniform motion, the velocity is as the space directly and time inversely; and supposing the gearing of the engine to be such, that each ascent or descent of the piston, produces $\frac{1}{u}$ part of a revolution of the adhesion wheels, the time of one revolution of the crank, will be $= \frac{2}{u} \times$ time of one revolution of the adhesion wheels. It thus follows that $E : P''' :: \frac{h}{2} : \frac{2r}{u}$; or, $E = P''' \times \frac{uh}{4r}$; and substituting for P‴ its value $\frac{2}{3}$ P, the following practical formula is at once obtained, viz.:

$$E = P \times \frac{uh}{6r}.$$

In the "Planet" engine, described by Mr. Wood, the following values obtain, viz. $r = 2.5$ ft. $h = 1.33$ ft. and $u = 2$; and therefore in this case $E = P \times \frac{3}{4\frac{3}{3}}$: showing that engine to be capable of yielding an effective pressure of only about 17 per cent. of the whole pressure upon the pistons, even without regard to inertia and friction. This engine is stated by Mr. Wood to be capable of yielding an effective pressure of upward of 30 per cent.! Indeed, the effective pressure of the English engines appear to be much overrated by Mr. Wood, as will be seen from an application of the above formula.

In an engine recently constructed for the Lexington and Ohio Railway, the following values are given, viz: $r = 1.5$, $h = 1.5$, and $u = 2$; and therefore $E = P \times \frac{1}{3}$; indicating an effective pressure of 33 per cent. when inertia and friction are not considered.

Let T = force of traction in lbs. which an engine may be required to exert upon its own carriage and upon the load; f = a force of traction in lbs. which is equivalent to the inertia and friction of the machinery of the engine; c = surface area of pistons in sq. feet; p = pressure per sq. inch upon the pistons; b = gallons of water which the boiler is capable of evaporating into steam per hour; v = rate of travelling in miles per hour.

From known principles the following formula is soon obtained, viz:

$$v = \frac{15\,br}{4\,uchp}$$

The whole pressure upon the pistons is denoted by $144\,pc$; and therefore $144\,pc \times \frac{uh}{6r} =$ effective pressure, without inertia or friction; or, $144\,p\,c \times \frac{u\,h}{6r} - f = T$; and eliminating p, the result is,

$$p = \frac{r \times (T + f)}{24\,c\,u\,h}$$

Substituting this value for p, in the expression for the value of v given above, the following general formula is the result, viz.

$$v = \frac{90\,b}{T + f}$$

Taking the case of the engine "Atlantic," as given in a report of the chief engineer of the Baltimore and Ohio Railway, the following values obtain, viz: $b = 300$ gal. $f = 450$ lbs. and the adhesion of the wheels = 1120 lbs. In this case therefore, $v = \frac{27000}{1570} = 17\frac{1}{3}$ miles per hour, being the velocity with which this engine will travel when exerting a force of traction equal to the adhesion of its wheels; the same result as given in said report very nearly.

A general expression has thus been investigated, for determining the velocity with which a given locomotive will be capable of travelling, when it has to effect any given force of traction. But upon curves the traction will vary with the velocity, in which case a different formula will be required. Let w denote the weight in lbs. of an engine, capable of moving a load with the carriages whose weight in lbs. is W, with a velocity v in miles per hour, upon a curve whose radius in feet is R, and upon a grade whose ascent or descent in a distance unity is n, and in carriages whose moving friction is m.

The following is then the general formula:

$$V^3 + V \times 60R. \left\{ m \pm n + \frac{f}{w + W} \right\} = \frac{5400\,R\,b}{w + W}.$$

Which cubic will give the velocity when the engine moves under circumstances of various loads, grades, and curvatures. The investigation I omit for want of room in this Journal, and will only observe, that it is easily obtained from the preceding.

Should the calculations given above be found, upon further examination, to be defective in principle, still it is hoped that they may be the means of suggesting to the scientific engineer some hint which may guide him in the pursuit of an investigation leading to results more consonant with experience; and thereby enable him to estimate the performance of any proposed locomotive engine, from the pressure and quantity of steam given, with more precision than seems to have been hitherto understood.

V. D. G.

Lexington and Ohio Railroad.
18th Dec. 1832.

STEAM ENGINE.—The following very extraordinary performance of a locomotive engine, on the Philadelphia, Germantown and Norristown Railroad, is taken from the Philadelphia National Gazette. According to this description Mr. Baldwin has outdone all who have constructed locomotives before him; and we may say also, the most sanguine anticipations of the friends of railroads. At 60 or 40, or even 20 miles the hour, a complete revolution would be effected in the mode of doing business; and it will be done, too, before many years.

"The extraordinary speed and power of the locomotive on the Germantown Railroad should excite more attention than it has obtained from the enlightened community in which it has been made. It is the more remarkable because it is in many points original, and because it is the very first working engine of the locomotive kind made by Mr. Baldwin, and yet it has surpassed in fleetness and proportional working power, any engine of whose performance we have been able to find any authentic account. In the celebrated trial of speed and power on the Liverpool and Manchester Railroad, the "Novelty," of Braithwaite and Erickson, took the palm for swiftness, and the "Rocket" of Stephenson that for power and efficiency. The former has not been since heard of, because of its want of adaptation to useful purposes, whilst the slower engines of Stephenson have been at work on almost every English railroad. According to the partial estimate of its friends, the Novelty, *on that fine railway, cleaned for the occasion, and on a set day of trial*, ran a mile in a minute, while Stephenson's engine requires a minute and a quarter to pass over the same space, or travelled on a straight and level road at the rate of 40 miles per hour. At present his locomotives take an hour and ten minutes to go the thirty miles between Low-hill and the depot at Manchester. In the trials recently made on Mr. Baldwin's engine, the road was muddy so as to impair the grip, and to lessen the smoothness, and she was used immediately after her return from her afternoon's trip to Germantown. For the experiment a space of two miles and a quarter was selected, in which there are four curves, and several very muddy crossways. In passing through this space the steam was *cut off at each curve* so as to *visibly* lessen the speed, and yet the whole distance was passed over in 3 minutes and 3-8ths. It was therefore done at the rate of 40 miles per hour. On the straight lines the speed seemed much greater, but no estimate of it was then made. On a subsequent day, however, when Dr. Patterson, of the University of Virginia, was in the 'tender,' the mile on a straight line was run through in 58 seconds according to the estimates of one computer, whilst another observer of time counted 52 seconds. That the distance might have been run in less time was obvious to all, for Mr. Baldwin made the engineer cut off the steam entirely, to check a career which he feared might become too great for the strength of the road, or the tenacity of the parts of the locomotive. At 58 seconds, the speed was more than 62 miles per hour. From this rapid movement no inconvenience was felt by the passengers: but a stiff breeze was produced by the quick motion through the air so as to endanger the security of the hats.

"By the contract the weight of the engine was, we understand, limited to 5 tons, so that on a muddy rail the weight is not such as to secure a grip for a very long and heavy train of cars. What the engine could draw on a clean road cannot be well ascertained, for another reason. The rails not being inclined laterally, the space pressed by the inclined rim of the wheels is very limited; but when over-loaded, the engine has shewn her great power by turning her wheels on the rails, whilst the grip was not adequate to the propulsion of her load. By this we perceive that she can pull as much as it is possible for any engine of the same weight to pull on that road.

"Although formed on the basis of Stephenson's engine, Baldwin's is superior in simplicity and compactness. The boiler is lighter in front, the pumps are formed in the guide rods, there is but one rod and rock shaft attached to the main valve; the throttle valve is a sliding one, placed close to the station of the engineer, and managed by a very short rod and lever. The eccentric has no lateral motion, but is reserved by moving the rod to the opposite side of the centre of motion of the rock-shaft.

"Power and fleetness having been adequately obtained, simplification was that for which Mr. Baldwin sought, and in that he has succeeded so well as to leave little if any room for more pruning. The arrangements are such, too, as to enable the engineer to observe and correct defects without penetrating to the interior of the boiler. A man-hole is therefore unnecessary.

"On the whole, as the first instrument of its kind, containing so many new points, and issuing from the hands of a mechanic who never before constructed such a machine, its strength, ease of motion and fitness, must appear remarkable. As far as our opportunity of judging goes, we are warranted in esteeming this en-

gine the best that has yet been constructed in any country, and fully capable of going at the highest speed compatible with comfort or safety. M.

The following account which we copy from the Mechanics' Magazine, of the first attempt to use steam for propelling vessels in England, brings forward a new claimant to the honors of that important discovery. It is an honor *well worth* contending for—"Honor to whom honor is due," is our motto.

HISTORY OF STEAMBOATS—*New Claimant to their Introduction.*—Mr. Wm. Bromilow, a correspondent of the Liverpool Chronicle of Saturday last, has brought forward a new claimant to the introduction of steam navigation in the person of a John Smith, late of St. Helen's.—Indeed, the facts, if authentic, leave no doubt that he has a prior claim to both Bell and Fulton. Mr. Bromilow's statement is as follows:

"'The engine in the boat alluded to, and which is generally supposed to be the first invented, was constructed for propelling boats by steam, as before stated, by Smith at St. Helen's, in the year 1793, and her first excursion was down the Sankey Canal to Newton Races, in June in the same year, laden with passengers. On the Saturday following she sailed to Runcorn, from thence down the Duke of Bridgewater's Canal to Manchester. On her arrival there, such was the astonishment and curiosity at this wonderful, and as some would have it, this mad idea, that thousands of the people came from all directions to see what their eyes would not believe, nor their senses understand; and, indeed, such were the numbers, and such the curiosity this vessel excited, that Smith was obliged for the safety of his property, to give notice that no one would be allowed to come on board of her, excepting those who paid a certain sum. This exasperated the populace to such an extent, that a party of mechanics immediately got possession of, and almost destroyed her. Amongst the visitors was Mr. Sherratt, of the firm of Bateman and Sherratt, of Manchester; also several other respectable engineers of the same place, whom it is unnecessary to name. So far as memory serves me, (after a lapse of 39 years,) the following is a short description of this wonderful discovery; but having made no memorandums of the circumstance at the time, and, I may say, being then young, and to a certain extent, like the rest of my friends, incredulous, I never anticipated what is almost to every one in the present day so common. The vessel had on her an engine on the old atmospheric principle, was worked with a beam, connecting-rod, double crank, in an horizontal line, and with seven paddles on each side, which propelled her at the rate of about two miles an hour. John Smith was a rude, uncultivated, self-taught mechanic, and was supported with money by a Mr. Baldwin, at that time of St. Helen's, and was the first æronaut who ever ascended in a balloon, either in this or the adjoining counties. Perhaps, I may observe, that the vessel or boat was purchased at Liverpool, and on Smith's informing the parties from whom he bought it what his intentions were, he was treated as some insane person: he was laughed at by one, insulted by another, and pitied generally; but, having money with him, he was allowed to purchase her. On being questioned and laughed at by a merchant at the time the purchase was made, he replied, '*those may laugh who will, but my opinion is, before twenty years are over, you will see this river (Mersey) covered with smoke.*'

"I feel pleasure in giving you these particulars, and the substance of the remarks I can vouch for as being correct, having been an eye-witness to most of them, and one of the party who took his first excursion."

[*From the London Times.*]

NEW STEAM-CARRIAGE.—A steam-carriage, constructed by Col. Macirone and Mr. J. Squire, Paddington-wharf, and which professes to be, by the superiority of its peculiar boiler, and the simplification of its machinery, a decided improvement on all former vehicles of that description, has been exhibited for some time past in the neighborhood of Paddington. We drove out in it a few days ago along the Harrow-road, with, in all, 11 persons. The utmost velocity on level ground was near 10 miles an hour; a part of the road covered with a coating of loose wet pebbles was crossed at a rate of about 8 miles; and the bridge over the Grand Junction Canal, where the steep is rather a smart one, at 4 or 5 miles an hour. It ought to be observed, that at this time the first fire was burning, and that therefore the boiler might not have been heated to its maximum. The jolting was not much greater than an ordinary stage-coach. When moving rapidly, the noise of the engine was lost in that of the carriage, but observable to the passengers as soon as the speed diminished. Some of the horses on the Harrow-road shied on seeing it.

The appearance of the vehicle, its boiler and

grate being covered with a casting of sheet iron, and surmounted by a short chimney, seemed to be the cause of this, as there was no smoke perceptible. But on running down the Edgware-road, followed by a delighted crowd of boys and girls, it caused no alarm to the horses there. The command of the conductor over it was remarkable. Its speed was readily diminished, short turns were made with apparent ease, and hills were descended at a satisfactory pace. The whole distance travelled was about five miles, and in performing this, 3-4ths of the first supply of coke was expended. We were not able to witness the results of the second fire.

On setting out the proprietor stated that the pressure on the boiler was 300 lb. the square inch, and the pressure on the pistons nearly the same. The weight of the whole vehicle when ready to move, with its supply of fuel and water, was stated by him at 2¼ tons. Weight of the boiler 17 cwt. thickness 3-16ths of an inch, usual quantity of water in it 20 gallons, utmost distance ever travelled with one supply of fuel and water near 12 miles, utmost cost of fuel per mile 3d, diameter of the (two) pistons 7 inches each, piston stroke 16 inches, the length of the steam-pipe, which he asserts does not affect the power at the working point, seemed to us about 12 feet. Descending from the boiler, it turns horizontally, runs under the body of the vehicle to the conductor's seat, then turns backward at rather a sharp curve, and enters the cylinders.

The pistons are connected with a frame, which rests on one pair of very free elastic springs, placed at the front of the carriage. The boiler rests on much stronger ones, but also elastic. It may be necessary to mention this, as it has been said that in steam-carriages the springs have been springs only in name. The boiler is not tubelar, but the proprietor declines stating its peculiar nature until he has secured a patent. One circumstance stated by him is remarkable. He positively declares that though his steam-carriage has worked, on an average, four or five days a-week since last June, it has not cost him a penny for repairs, excepting the charge for one new set of fire bars.

Railroads.—The long projected railway from Birmingham to London is again to be brought before the legislature. It is expected that the railway will be continued from Birmingham to Liverpool, and from thence to Edinburgh. The Southampton to London, by Fauxhall, Wandsworth, and Kingston, across Ditton-Marsh and Walton-common, to Weybridge, thence south of Basingstoke Canal to Trimley, where it will cross and proceed to Winchester, and through Stoneham to Southampton. The whole distance of the line will be rather less than seventy-seven miles. The railway from London to Brighton projectors intend to apply for a bill. Every preparation has been made to commence the railway from London to Greenwich. It will be continued to Woolwich, thence to Chatham and Dover.—The French have it in contemplation to make a railway from Calais to Paris.—[London paper.]

English Patents.—Specification of the patent granted to George Forrester, Civil Engineer, for certain improvements in Wheels for Carriages and Machinery, which improvements are applicable to other purposes. Dated September 5, 1831 :—

To all to whom these presents shall come, &c. &c.—Now know ye, that in compliance with the said proviso, I, the said George Forrester, do hereby declare, that the nature of my said invention, and the manner in which the same is performed, are described and ascertained in and by the following description thereof, reference being had to the drawing hereunto annexed, (that is to say)—

My invention consists in a peculiar mode of combining cast iron with wrought or malleable iron in the construction of wheels of all descriptions, (excepting those of such small dimensions as the wheels of clocks and watches,) and in the application of the same principle of construction to the framing for steam engines and machinery, the arches of bridges, and in every case in which cast iron framing may be employed, and wherein great strength and lightness are desiderata.

My mode of accomplishing the aforesaid combination is as follows :—I make a skeleton, or light frame, of wrought iron, or steel, of the shape of the article required, but of considerably less dimensions ; this skeleton I render bright, free from oxide, and clean, by any convenient operation, such as grinding, scouring, and filing, to adapt it to receive a coating of lead, or bismuth, or tin, or zinc, or any mixture of those metals, such coating being performed by similar means to that used in the well known process called "tinning." The article to be cast having been moulded in sand (or loam) in the common way, the skeleton, coated as before mentioned, is carefully laid in the middle of the respective parts of the mould,

projecting pieces being attached to the skeleton to keep it in its proper place; the mould is now closed, and the cavities formed by the pattern, are to be filled up with fluid cast iron, which completes the operation.

By this mode of embodying or enveloping wrought iron or steel skeletons of the shape of the intended article, with cast iron, the latter material is not injured in its tenacity, while the former is considerably improved, and thus the important qualities of toughness and infrangibility are introduced into forms more perfect, and structures more solid than can be obtained in wrought iron alone. To prevent misconception, I annex a drawing illustrative of the construction of one of the leading objects of my invention, that of wheels for railway carriages, and which will also serve satisfactorily to explain the mode of applying the principle of construction to the purposes before named.

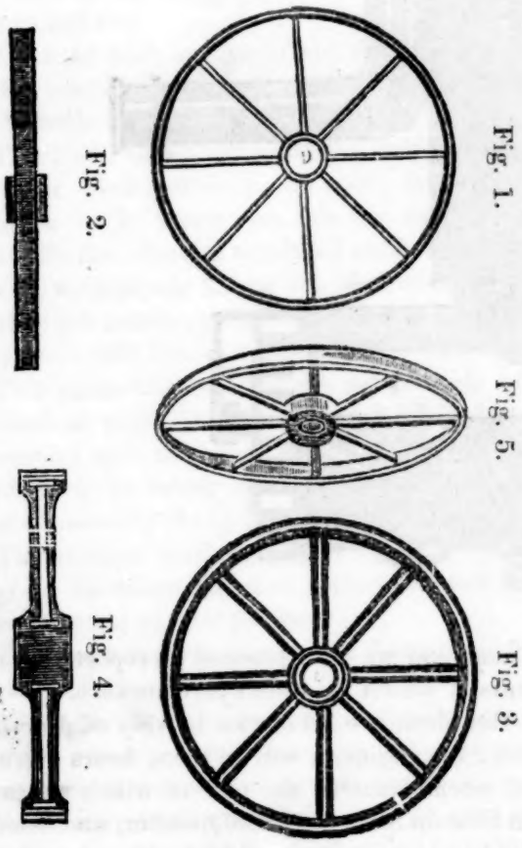


Fig. 2.

Fig. 1.

Fig. 5.

Fig. 4.

Fig. 3.

DESCRIPTION OF THE DRAWING.—Fig. 1 exhibits a side view of the wrought iron or skeleton framing before described.

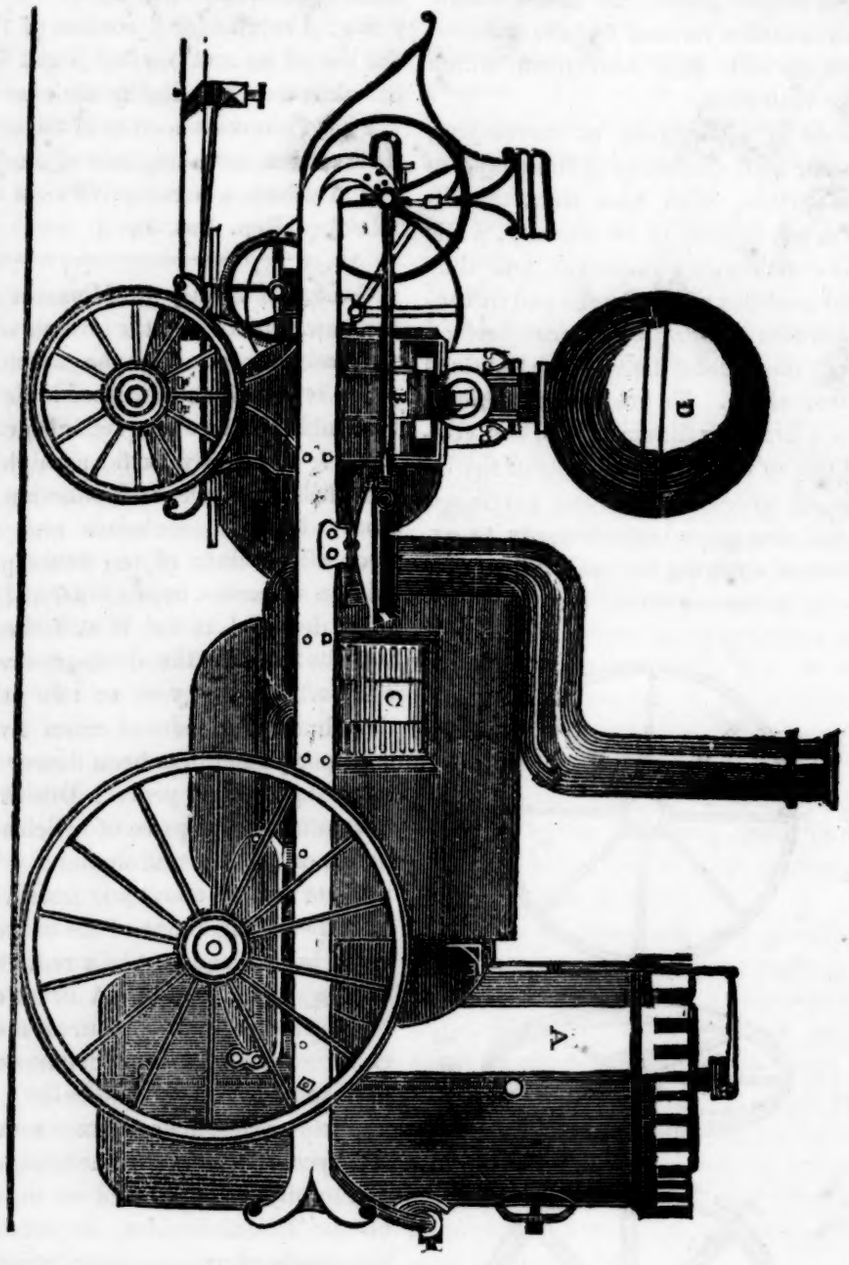
Fig. 2 shows an edge or outside view of the peripheral ring of the skeleton, showing its proportional breadth, and containing a number of holes made throughout its circumference for the purpose of allowing the fluid iron, in casting, to flow through the holes, and fix itself in a solid mass around the skeleton.

Fig. 3 represents a section of the wheel in the line of its motion, the blank line showing the skeleton embodied in the cast iron.

Fig. 4 shows a section of the wheel through its diameter, including two of the spokes; and Fig. 5 affords a perspective view of the entire wheel.—[Rep. Pat. Inv.]

SALT.—A farmer in Missouri asks through the newspapers for the reason why, when the duty on salt has been so much reduced, the price is so much increased? Is it not a fact that high duties often reduce prices, and *vice versa?* Certainly, so far as high or low duties diminish or increase production or consumption. Instance molasses and coffee. Very soon after a duty of ten cents per gallon was laid on molasses, by the tariff of 1828, its selling price declined in the West Indies and the United States—for the distilleries were stopped; and coffee, for a year or two past, though the duty had been reduced from five cents to one cent per pound, has been dearer than it was in several preceding years. Duties may, or may not, enhance the price of articles—for price depends on supply and demand. The advanced price of salt, as above suggested, may be caused by a discouragement of the makers of it in the west, in consequence of a reduction of duty on the imported article. A brisk competition among producers is the surest means of cheapening commodities to consumers. But it is hard to make the people believe that duties on imports are not always taxes imposed on them; and yet a greater or more injurious mistake can hardly be committed on the subject of taxation. Price, besides, is relative. Tens of thousands of persons were starving in Ireland when potatoes were selling for less than one-third of a cent per pound—at which time they were worth in the cities of the United States one and a half cents per pound; but the first had not the means to purchase potatoes, and hence they were dear in Ireland, though cheap in the United States.—[Niles' Reg.]

We learn that subscriptions were taken recently for a new joint stock company, to establish a line of steam-carriages between this town and Boston, over the turnpike. The plan is said to be to run a carriage every hour in the day, each way; and if the project is successful, the line will be continued to Newburyport.—[Salem Gazette, Mass.]



[*From the London Mechanics' Magazine.*]

THE STEAM FIRE ENGINE "COMET."—We give at the head of the page an engraving of a new steam fire engine, which has been built by Mr. Braithwaite for the King of Prussia, and has been named the "Comet," (in honor we presume of the portentous stranger whose near approach is

——with fear of change
Perplexing monarchs.)

It is intended to be exclusively employed for the protection of the public buildings of Berlin, and will in a day or two take its departure for that capital. On Monday last we were present at a public trial of its capabilities at Mr. Braithwaite's Wharf, on the Paddington Canal, and we now proceed to report the results of which we were eye-witnesses.

But first, a word or two by way of description: the engine, it will be seen, bears a general resemblance to the one of which we gave an account of in our 340th number, and which has been repeatedly employed with so much effect at fires in this metropolis. A, the boiler, is on the same plan as that of the Novelty, with this exception, that the combustion is promoted by means of an exhauster F, instead of a bellows; the flue is in two lengths, and the greatest diameter 5 inches. The steam cylinder, (C) is 12 inches in diameter, with a 14 inch stroke. The water cylinders, of which one only (B) is seen in the engraving, are ten and a half inch-

es in diameter, with also a fourteen inch stroke. The steam from the eduction pipe is conveyed through two coils of tubing laid in the water tank, and imparts a considerable degree of heat to the water before it is transferred to the boiler. D is the air vessel, E the furnace grating. The feed pump, (not seen in the engraving), is equal to the supply of from 20 to 25 cubic feet of water per hour.

The steam having been got up (in 20 minutes as we were informed) and the pressure in the boiler being at 70 lbs. the square inch, the engine was set to work with a single pipe applied, of 1¼ inch in diameter. The height to which the water was ejected could not be less than from 115 to 120 feet. The number of strokes per minute was eighteen, which gives for the quantity of water thrown 1 ton 7 cwt. 13 lbs. per minute. For,

The water cylinder being 10½ in diameter, the area of the water piston must be 86.6 square inches;

And a 14 inch stroke of the engine, gives for the length of the stroke in the water cylinder 56 inches;

Therefore, 86.6 × 56 = 4849.6 cubic inches of water each stroke = 2.8 cubic feet. Deduct for back water through the valves, 1, leaves for the effectual result 2.7 cubic feet;

And, multiplying 2.7 by 18, the number of strokes per minute, we have 48.6 cubic feet per minute = 3037 lbs. = 1 ton 7 cwt. 13 lbs.

Two pipes were afterwards substituted, of 7-8 inch in diameter; then four of 5-8 inch in diameter; and the effect produced in each instance was as nearly as possible equivalent to that obtained by the 1¼ inch jet.

The average working power of the engine may be therefore stated at between 80 and 90 tons of water ejected per hour.

The consumption of coke per hour is about three bushels.

The sum agreed to be paid for the Comet is £1200; but we should imagine that this can scarcely be a remunerating price for an engine of such magnitude and power, and finished in a style of workmanship which called forth the most unqualified encomiums from the numerous engineers and other scientific persons present at the exhibition of Monday last.

[*From the New-York Farmer.*]

Docks, Edifices, and Commerce of Liverpool.—As Liverpool is generally the first landing place of Americans crossing the Atlantic for business or pleasure, perhaps some little notice of it will be interesting to your readers. The spacious docks into which ships are admitted on their arrival always excite the wonder of an American—showing in a most astonishing degree the power of science and art, in overcoming what would, but a few centuries since, have been considered insurmountable obstacles. They are of three kinds, the principal are the west docks, which chiefly receive the ships in the foreign trade which have large and heavy cargoes to receive and discharge. In these the ships are afloat at all times of the tide, the water being retained by the dock gates. The next one is the dry dock, or basins, as they are called, because they are left dry when the tide is out: these generally receive the vessels which are employed coastwise.—The others are the graving docks, which admit or exclude the water at pleasure, and in which the ships are laid dry for the purpose of repairs. Prince's Dock is where the American ships lie, and is exceeded in size by the Queen's Dock only. It was commenced in 1815, and completed in 1821. It is 500 yards long, and 106 broad, and covers an area, including its two locks, of 57,129 yards. It has gates, each of which is 42 feet wide and 34 deep, with locks at each end. The locks are constructed so as to admit vessels in and out at half tide. This dock is built of uncommon strength, and according to the most approved principles of naval architecture. It is inclosed by gates at convenient distances. At the north end is a dwelling house, with suitable offices for the Dock Master. The quays are spacious, on which are erected sheds to preserve merchandise from the effects of rainy weather, of which they have much at Liverpool. Spacious as the docks are, they are still considered as too limited for the increased commerce of the port.—As a sample of the increase of shipping and duties at Liverpool, I annex the following:

	Vessels entered.	Amount of Duties.
In 1760	1,245	£2,330 3 7
1800	5,746	24,379 13 6
1810	6,729	65,782 1 0
1820	7,276	117,962 14 6
1830	11,224	151,329 17 10

The population of Liverpool is estimated at about 165,000, showing an increase in 10 years of upwards of 46,000. The suburbs are very populous, and contain at least 40,000 inhabitants. Liverpool contains no valued remains of ancient barbarous, or classic architecture; no antique inscriptions in characters half obliterated by time; nor any of the more portable

reliques which adorn the antiquarian cabinet, rendered sacred by the rust of ages. The attention is not arrested by sudden and frequent revolutions, nor the imagination seized with tales of

"Deeds heroic, sieges rais'd, or battles won."

Its history is the history of the silent but powerful operations of industry, and its topography stands an honorable monument of ardent activity, and well-directed enterprise.

The public structures devoted to religion in the town of Liverpool are numerous, and their size and the high style of elegance in which many of them are finished, render them superior to most in the kingdom. They are among the first objects that deserve the attention of the stranger. St. Nicholas, or the old church, is said to be the oldest ecclesiastical foundation in the town, and although it would be difficult to trace its primary history, a licence to bury in the cemetery attached was granted in 1361, by the Bishop of Litchfield, who then presided over this diocese. Its situation is near the docks. In the church-yard was formerly a statue of St. Nicholas, who in the papal calendar is made the tutelar deity of the mariner, to whom the sailors presented an offering on going to sea, to obtain from the saint a prosperous voyage and a safe return.

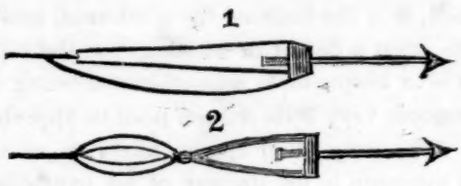
The interior of the church presents few venerable remains of ancient dignity, most of them having been displaced to make room for modern decorations. The font is of white marble, the cover or cap of which is a curious composition in the style of ancient crosses. An ancient manuscript thus describes one of the chantries: "The chantry of the high altar of the foundation of Henry, Duke of Lancaster, to celebrate therefore the souls of himself and his ancestors;" which is observed accordingly, and the grant is forever. There are about 30 churches, and from 12 to 20 what are termed chapels, being of other denominations than those used by the established religion. The church of the school for the blind is well worthy of attention. The objects in erecting this beautiful church were, first, to accommodate the blind pupils with a place of divine worship near the school; the other, that the superior singing and music made by the pupils might attract those having a taste for music, and that would contribute to the funds for their support. One half of the pews are reserved for strangers, who I believe are universally gratified, and always contribute their mite for an object so deserving.

A very excellent specimen of stained glass may be seen in the altar window. The subject is the Ascension; the reflection of the light through it is exceedingly beautiful. The architect copied for the portico at the west end, the portico of the Temple of Jupiter Panhellenius, in the isle of Ægina, which is really a most beautiful design. B. P.

[*From the American Railroad Journal.*]

Foot Railroads, No. II.—In No. 23, Scientific Tracts, it is stated that a horse, at five miles an hour, usually exerts the force necessary to raise 45 lbs. over a pulley, and draws on a level railroad about four tons. At two miles an hour, he usually exerts a force necessary to raise 112 lbs. and draws on a level railroad about 10 tons. It is computed that a man can draw on a horizontal line about one-seventh the load a horse can draw; and therefore, he could draw at two miles an hour 29 cwt. or more than two horses could draw on a common road at four miles an hour,—and more than a yoke of oxen could draw at two miles an hour. One man on a level railroad could move, at two miles an hour, more than a yoke of oxen could move at the same rate on a level road. But, on a railroad, there will be some portions where the road will not be perfectly level. If, in these portions, there is a rise of one foot in eighty, or sixty-six feet in a mile, then, to overcome this ascent, there must be exerted a force sufficient to raise over a pulley one-eightieth of the load, in addition to the force necessary to move it forward on a level. To move it forward on a level, he must exert a force sufficient to raise 16 lbs. over a pulley; and, in addition to this, to draw 29 cwt. up an ascent of one foot in eighty, he must use a force sufficient to raise 40 lbs. over a pulley. A man, therefore, who with a cord over a pulley can raise up 56 lbs. can move a load of 29 cwt. up a railroad ascending one foot in eighty, or sixty-six feet in a mile; and, on a level, he can move such load as easily as he can raise 16 lbs. over a pulley. This shows the vast advantages of a railroad over a common road. The inquiry may now be made why a narrow, and therefore a very cheap, railroad may not be made for the use of men? If they can move forward on such a road only one ton, or even half a ton, they could easily do on one such road all the transportation that is needed on most of the routes leading to our principal market towns. Let those who have heavy articles to transport, and those who regard the

welfare of the community, inquire into this matter. PUBLICOLA.



[*From the London Mechanics' Magazine.*]

IMPROVEMENTS IN MR. MURRAY'S PLAN FOR INSTANTANEOUS COMMUNICATION WITH STRANDED VESSELS.—In No. 441, we gave an account of Mr. Murray's excellent invention for saving from shipwreck, abstracted from a pamphlet published by that ingenious and very philanthropic gentleman. We have now before us a "Supplement" to that pamphlet, in which Mr. Murray describes some material improvements which he has since effected. In the experiments which we last recorded, Mr. Murray had only got the length of being able to project his safety line from a common musket; but the purpose of the present "Supplement" is to announce that "in a thousand instances a *pistol* with an arrow and its line will afford sufficient means to convey a rope and establish a medium of escape from the wreck to the shore."

The improvements made consist in a better construction of the arrows, and will be readily understood from a comparison of the prefixed sketches with that given in No. 441. The arrows, 1 and 2, are made of solid iron, and the spindle is polished to allow the sliding appendage and the recoil-spring to fly backwards with as little resistance as possible. The arrow is of metal, because it is found to project much further than one of wood. The recoil-spring is of steel, which answers better than the cork or catouchet originally proposed. The snapcord is intended to meet the first sudden jerk, and provide a double curb to the violent impetus of the projected line, so that a charge of gunpowder double or treble what is usual may be employed. The arrow, No. 1, weighs, together with its appendages, $4\frac{3}{4}$ ounces, is one foot long, and $\frac{7}{8}$ inch in circumference. The arrow, No. 2, with its adjustments, $5\frac{3}{4}$ ounces, is $10\frac{1}{2}$ inches long, and 1 inch in circumference.

With the arrow, No. 1, Mr. Murray made the following experiments, making use of a pistol $8\frac{1}{2}$ inches long, and $\frac{11}{16}$ inch diameter in the bore, and a cord 110 yards long, weighing 11 ounces :—

"First experiment; at an angle of 40 degrees, with 23 grains of gunpowder, the arrow carried the line 71 yards.

"Second experiment; at an angle of 30 degrees, with 34 grains of gunpowder, the line was carried 72 yards.

"Third experiment; at an angle of 45 degrees, with 46 grains of gunpowder, the line was carried 85 yards.

"Fourth experiment; at the same angle, and with a similar charge, the line was carried 83 yards.

"Fifth experiment; at the same angle and with a similar charge, the line was carried 84 yards.

"In no instance did the cord break."

With the arrow, No. 2, the following results were obtained; but it does not clearly appear from Mr. M.'s statement, whether with a musket or a pistol :—

"At an angle of 45 degrees, with 46 grains of gunpowder, and the wadding hard rammed down, the arrow carried with it 110 yards of line.

"The cord, and all the adjustments as in the other experiments, remained completely entire, and were not, in the most remote degree, injured. The recoil, in the last case, however, was rather too violent, from the additional weight of the arrow, and the degree to which the wadding had been rammed down: a circumstance which it seems necessary to state.

"The gun which has been manufactured by Mr. Pritchard, of Birmingham, under my directions, can discharge eight drachms of gunpowder with great ease.

"The arrow, in this case, was formed of brass, with a sliding ring embracing the rod, and having the line attached to a loop, the whole weighing $6\frac{1}{2}$ ounces, carried a platted hemp cord, double the thickness of a garden line, more than sufficient to pull a considerable rope on board, from the shore, and adequate to form the requisite line of communication with the vessel. This arrow carried the line 57 yards, with only one drachm of gunpowder.

"In the second experiment the arrow carried the line 112 yards, with $2\frac{1}{2}$ drachms of gunpowder. These last experiments were made at Birmingham, and in no instance whatever did the line break."

Mr. Murray adds the following valuable practical remarks :—

"I. *The Arrow.*—The material of the arrow should be iron, and the more tough the better; perhaps old horse shoes, welded longitudinally and in separate pieces, will be the best, and

finally wrought in the manner of the English twisted gun barrels, or the French "*canons a ruban*"—or ribbon barrels, which approach sufficiently near to them.

"II. *Gunpowder.*—This differs materially in power and propelling force. It has, I believe, been estimated as high in some cases as equivalent to a thousand atmospheres. Col. Mark Wilks informed me, as the result of a series of experiments made by him at St. Helena, that semi-burnt charcoal very materially increased the power of gunpowder. Willow, hazel, and dogwood, are the woods which supply charcoal for powder mills; and the last, if I am correctly informed, is preferred at Battle for the manufacture of the finest kinds. The smaller grained is inflamed more rapidly than the other, and it should seem, from experiments made in reference to the question, that the inflammation is also more complete. A little lycopodium powder mixed with the priming, while it would facilitate the ignition, would tend very materially to protect it from wet, and therefore render it much more certain.

III. *Wadding.*—This may be formed of a slice of thin cork, or of an old hat or card punched out, or of soft brown paper, which last will seldom fall to the ground nearer than a distance of 20 or 30 feet from the muzzle of the piece. Some attention must be paid to this circumstance, since, if formed of too pliant materials, such as cotton, &c. it will not be of sufficient consistency for the purpose; it will, therefore, lose in force, and the shot will not be carried so far. On the other hand, if the wadding be too stiff and inflexible, or rammed down too firmly, the shot will spread, and the piece will recoil considerably more. A medium in both, therefore, will be found essential.

"IV. *Recoil.*—This arises from the retrograde motion of the piece, and is dependant on a well known law in mechanics, namely, that action and re-action are alike. Excess in the recoil may be generally traced to inequality in bore, but it is taken for granted that the piece has been submitted to the usual proof before it leaves the hands of the manufacturer. The weight of the piece being the same, the recoil will be in the ratio of the quantity of gunpowder and the weight of the ball, or other projectile. The recoil will also increase with the number of times the piece is fired, which would seem to connect the question with the evolution of moisture or expansion by produced temperature; it is also, as has been stated, attendant on the wadding being rammed down too firmly. The butt end of the gun must be held closely and firmly to the shoulder.

"V. *Bursting of the Barrel.*—This is a very rare event, and easily prevented. Sometimes, indeed, it is the fault of the workman, and proceeds from a defect in welding, but the reputation of a respectable manufacturer being compromised, very little danger need be apprehended. The only other causes likely to occur in this question is the danger of an over-charge, which a correct measure accompanying the powder flask or canister will most effectually prevent—the gun manufactured by Mr. Pritchard will bear 8 drachms of gunpowder, and not more than $3\frac{1}{2}$ drachms can ever be required, leaving a reversion of $4\frac{1}{2}$ drachms of powder. There therefore remains only another caution, and that is, the end of the arrow must be brought in complete contact with the wadding, which will be effectually secured by the angular elevation of 45 degrees—an elevation which secures the greatest range; the general cause of bursting in ordinary cases is to be attributed to the circumstance of the ball not being rammed home, and a space left between it and the charge of gunpowder.

"So simple an apparatus might be disposed of in a small compass, and when put up in a convenient case, kept on board vessels; it might thus be made available in a few seconds, in the hour of danger. The impulsion of the arrow would be materially assisted by the gale blowing towards a lee-shore, and it would have, in relation to the line of direction and its successful receipt on shore, the combined advantages of an extensive segment of a circle over a merely central point."

Not the least important feature of Mr. Murray's plan is its great cheapness, compared with every other which has been proposed:—"The expense required for the establishment of a few stations of Captain Manby's apparatus will supply some thousands of these, (blunderbusses, muskets or pistols)—in fact, suffice for the British isles." Mr. M. states, that a "gun with six arrows, two lines each 200 yards long, two tin cans to hold the lines, a powder-measure, a supply of wadding, &c., will cost (only) from 4*l.* to 5*l.*;" and "the smallest gun (query, the pistol?) with the apparatus complete, much less."

We are glad to perceive that the "National Institution for Saving from Shipwreck" have determined on forthwith introducing Mr. Murray's invention on the dangerous coast of Sussex; nor can we anticipate less than its speedy adoption along all our shores. Mr. M. adverts

with great modesty to the trouble and expense which he has been at to bring the invention to its present state of perfection, but rather by way of apology for not doing more in its behalf, than with a view to eliciting any public reward. We trust, however, that a great and generous nation will not on that account be the less disposed to mark, in some suitable manner, its sense of the valuable present he has made to it. If Captain Manby was thought well deserving of 3,250*l.* for his imperfect apparatus, it cannot be that the inventor of one in every respect superior to it should be suffered to go wholly unrewarded.

Importance of the Silk Culture—Aid from the General Government required. By A. W. To the Editor of the New-York Farmer.

The Chinese, knowing the great value of the silk manufacture, closely guarded the secret of its management by the most rigid penal enactments, by which means they were enabled for many centuries to keep the silk worm from spreading over the world, consequently monopolized the whole business, which was a source of much wealth to their empire.

Many fruitless attempts were made by crowned heads to obtain the worms, and to learn the mode of their management, but for a long time without success.

The prospect of great reward at length put a few eggs of the silk worm in possession of the Emperor Justinian. From this small beginning all the silk worms in Western Asia, Europe, and America, have been produced.—England, Holland, Germany, Russia, and Sweden, are fully aware of the importance of the silk business. France, more than any other nation in Europe, is deriving her power and greatest resources from the culture and manufacture of silk.

Our Treasury returns, for several years past, shew that the silk imported and consumed in the States is more in amount than the bread stuff exported. Silk may be successfully and advantageously cultivated in every state in the Union. Experiments have shown American silk to be superior in color and texture to the silk of any nation. Other agricultural labor will not be lessened by such culture. The condition of the poor will be much improved; the young and infirm will make good silk culturists.

The climate of England is too damp and cold to propagate the silk worm. America may yet reap great profit on raw silk as an article of export.

Jay made no mention of cotton as an article of American production, in his treaty with England, 1794. The present year's crop of cotton is worth about thirty millions of dollars. Many of our citizens, who about 38 years ago planted cotton seed, may be living witnesses of the fact, that cotton is the first staple in the states. A large portion of those who are now planting the mulberry seed may live to see raw silk the second grand staple of our country. The state of Connecticut has taken the lead in the growth and manufacture of silk. Many of her citizens are entitled to great credit for their persevering and patriotic efforts.

Mansfield has been engaged more or less in the raising of silk ever since 1760, and the quantity gradually increasing. Windham and Tolland counties have produced for the last year raw silk sufficient to employ fifty-five looms, which would manufacture about 30,000 yards per year, say vesting and other broad goods.

Considerable quantities of silk goods have been produced by the enterprising perseverance of Mr. Rapp, of Economy, in Pennsylvania. *Superior specimens of what might be accomplished by a judicious National fostering was exhibited last winter at Washington, by the venerable and learned Mr. Duponceau.*—Many other parts of the Union have produced specimens of silk stuffs and sewing silk; the latter article is found the most profitable, yet in manufacturing this, a great drawback to profit is experienced from not systematically understanding the art of filature, or reeling the silk from the cocoon. In other countries, where sewing silk is manufactured, the tow of the silk is worked in; but we are obliged to make use of the best part of the fibre. Our sewing silk is stronger than the Italian, but in consequence of our defective reeling it is very wasteful, difficult to keep from tangling, &c. The finishing of piece goods suffers from the same cause.

It must be obvious that something is materially wrong in the silk operations of our people, or the manufacturing of it would ere this be entered into much more generally.

The culture of silk was attempted in Virginia a century and a half before cotton was brought into notice. The growth and manufacture of cotton has progressed with astonishing rapidity—the value of our cotton manufactories is immense. It is now only 25 or 30 years since it was thought the ingenuity of our

people would not be equal to manufacture as good and as cheap goods* as the once celebrated India Baftas and Hummums. A very short period of experiment drove these very inferior trash from our shores. The bare mention of such fabrics being once in so general use in our country causes almost as much risibility as the fact of importing building brick from Holland. Our cotton goods now find their way to the Indies; our bricks are equal to any in the world; and with a little national protection, we will soon cease importing silk, and have raw silk to spare for a profitable export.

Many of the states, by their public acts, have shown their very decided opinion of the immense importance of the culture of silk, as a great and commanding National object; yet still, this grand object lingers.

The chairman of our Congress committee on Agriculture, 1832, speaking of the manufacture of silk, remarks, "On an experiment untried in this country, and requiring considerable capital, a reliance on individual enterprise would be at least problematical; and it is not to be expected that the several states will ever be found to act in concert so as to attain the result which a national operation is calculated to procure."

If the manufacture of silk should ever be undertaken upon an extensive scale in the United States, Congress must give us a National School, to teach the whole process of silk work, but more particularly the important art of filature.

The eight millions of dollars sent annually out of the country for silks, in its various forms, can be saved, and it is as well to begin now as wait another century. A. W.

Lansingburgh, Jan. 1, 1833.

* The home consumption of raw cotton has increased 600 per cent. within the last 16 years, while that of Great Britain has only increased 220 per cent. in 21 years.

[*From the London Mechanics' Magazine.*]

ERICSSON'S STEAM ENGINE AND WATER-MILL.—Perhaps the most interesting problem in mechanical science is how to simplify the steam engine, so that its bulk and weight, which are at present somewhat enormous, may be reduced within more convenient limits without any corresponding loss of power. Owing to a variety of causes, all well ascertained by long practice, a reciprocating engine cannot be made to work to advantage at more than a moderate rate of speed; it becomes therefore necessary to expose the piston to a great force, (for that force multiplied by the speed constitutes the power,) and, as a necessary consequence, all the parts that have to communicate this great force, as well as the frame work that carries those various moving parts, must be made strong in proportion. Hence it follows as a general rule, that the bulk and weight of any engine of a given power, worked by steam of given force, must depend on the speed of the piston, that is, the speed of that surface which the steam is made to propel. This truth forms the basis of the construction of the very remarkable engine which we have now to bring under the notice of our readers.

In the patent which Mr. Ericsson has taken out for this invention, he designates it as "an improved engine for communicating power for mechanical purposes;" and this generality was, perhaps, necessary, since, though it promises to be of most importance in connection with steam, it may be worked by any other gaseous or fluid power, as air, water, &c. The specification describes it more particularly as consisting of a "circular chamber, in which a cone is made to revolve on a shaft or axis by means of leaves or wings, alternately exposed to the pressure of steam; these wings or leaves being made to work through slits or openings of a circular plane, which revolves obliquely to, and is thereby kept in contact with, the side of the cone." But when the reader has read this description of the engine, we are afraid he will not be much the wiser for it; indeed, we never before met with an engine of which it was so difficult to convey, *in words*, a clear and distinct notion, and which was at the same time so little complex in its construction. We shall, therefore, be obliged to depend more than usual on the assistance of our engraver, to make the following description plain to our readers.

Fig. 1 represents a longitudinal section of the engine, the circular chamber being supposed to be cut through the centre line. A A is a circular chamber made in two parts, joined at *a a*, and fixed to a frame B B; this frame also supports the axis or main shaft C, to which is fixed the cone D. E E are two wings or leaves fixed to the cone; and *e* is a metallic segment, fitted into a groove made in the curved edge of the leaf, and pressed towards the chamber by springs in order to prevent the escape of steam. F is a circular plane, revolving on a shaft or pivot G, and supported by the main-shaft (as shown in fig. 4.) The oblique position of this circular plane, it will be seen, is so adjusted that its surface shall be parallel to, and in con-

Fig. 1.

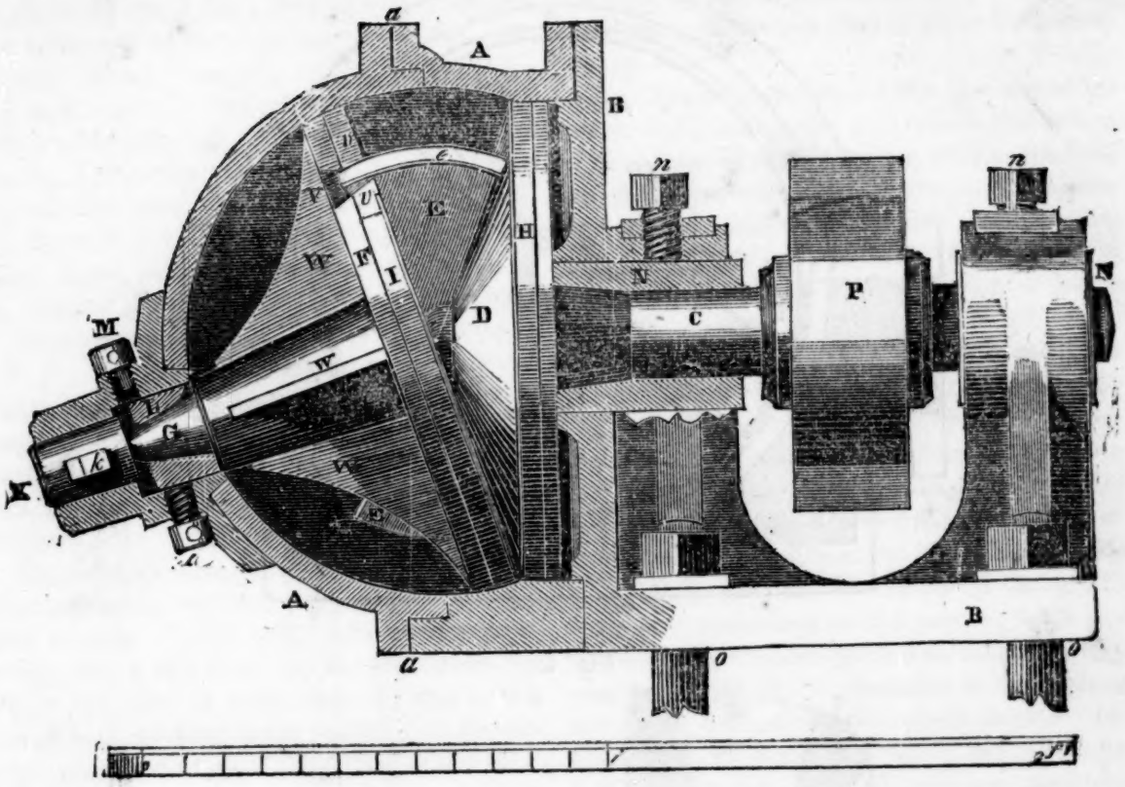


Fig. 2.

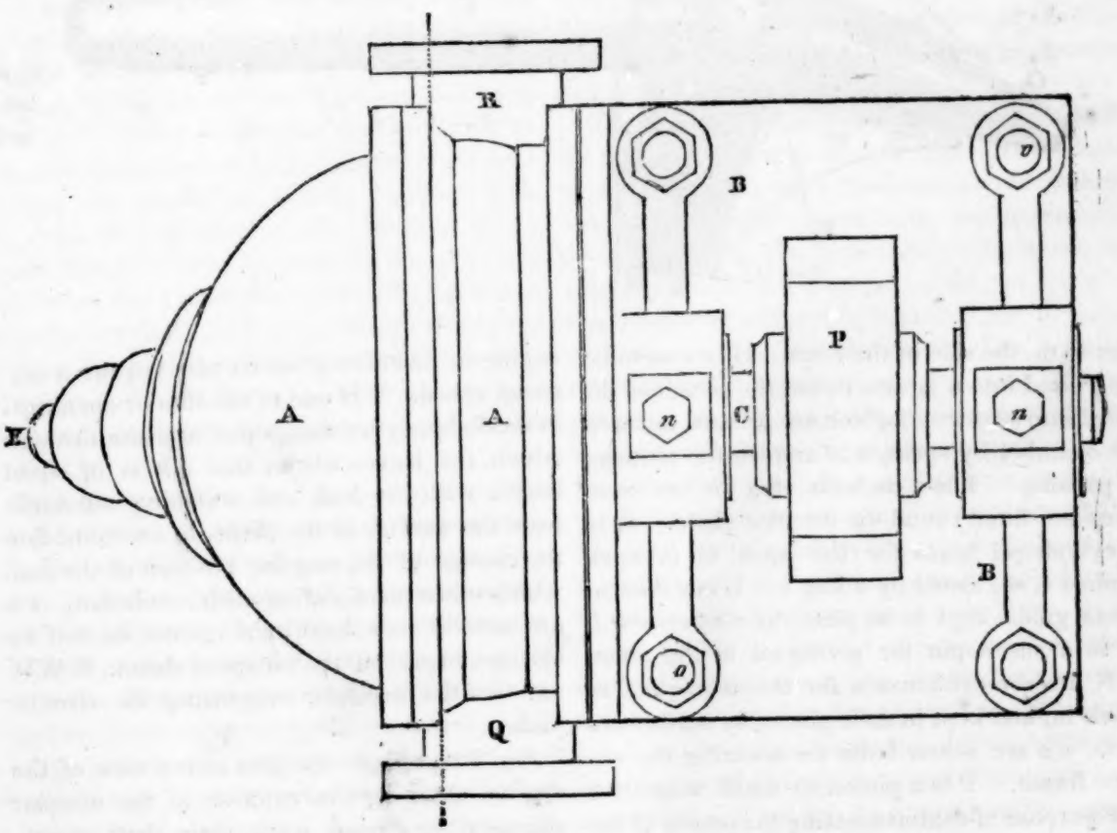


Fig. 3.

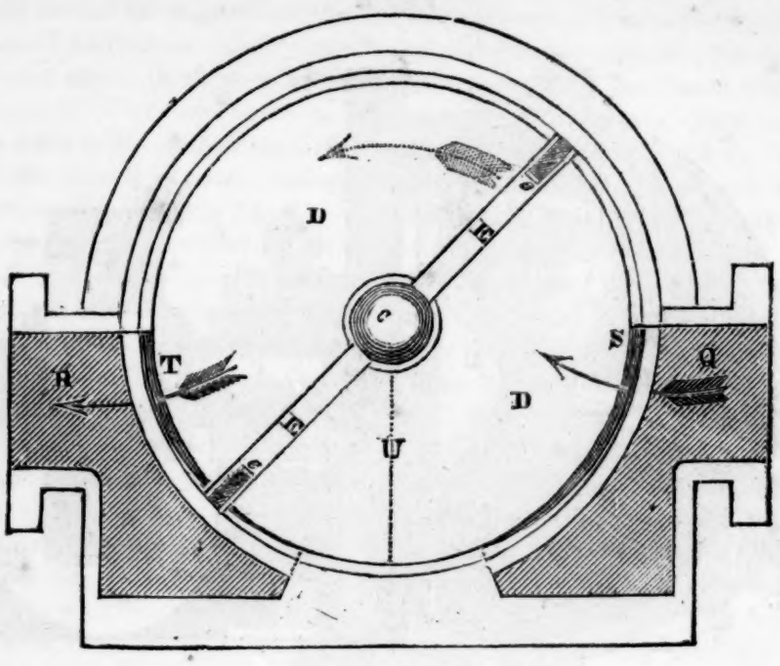
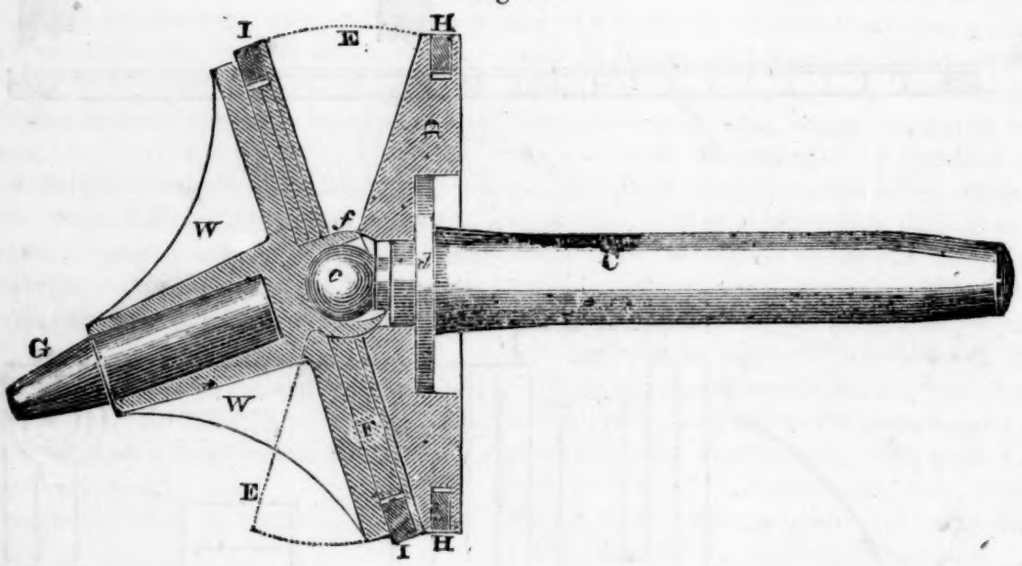


Fig. 4.



tact with, the side of the cone. H is a metallic ring fitted into a groove round the cone, and divided into segments, which are pressed towards the chamber by springs, to answer the purpose of packing. I is a metallic ring for the same purpose, fitted round the circular plane. K is a cylindrical brass for the pivot G to work against *e*, regulated by a key *k*. L is a conical brass guide, kept in its place by a set-screw *l*. M is a screw-pin for giving oil to the pivot. N N are conical brasses for the main-shaft to work in, and kept in their places by set-screws *n n*. *o o* are screw-bolts for securing the engine frame. P is a pinion or small wheel, for the purpose of communicating the power of the engine to machinery which may require a different speed. V is one of the slits or openings, in the obliquely revolving circular plane, through which the leaves work; this slit is of equal length with the leaf, and widening outwards from the surface of the plane, to accommodate the change of the angular position of the leaf, which takes place during each revolution. *v v* are metallic rods, kept tight against the leaf by springs, to prevent the escape of steam. WWW are thin flat arms for supporting the circular plane.

Fig. 2 represents the plan or top view of the engine, showing the exterior of the circular chamber, the frame work, main shaft, pinion,

c. (It may be as well here to state, that similar letters are used to denote similar parts in all the figures.) Q is the pipe through which the steam enters the engine, and R the pipe through which it escapes.

Fig. 3 is an end view or cross section of the engine, taken through the dotted line marked in fig. 2. The steam passes from the pipe Q into the circular chamber through an opening S, cut through its side; this opening is of a triangular shape, and made as wide at the top as the circular plane is there distant from the base of the cone, and gradually tapering off downwards. T is the opening through which the steam escapes, and in every respect similar in construction. The dotted line U shows where the cone and the circular plane come in contact. *e e* are the metallic segments already described.

Fig. 4 is a detached view of the cone in the circular plane, representing a section through their centres. It will only be necessary to observe, that *d* is a collar on the main shaft, by which the cone is fixed thereto; that *c* is a socket-ball, working in the socket *f* of the circular plane; and that the dotted lines E E show the precise shape of the leaves or wings fixed to the cone.

Having thus described the nature and construction of Mr. Ericsson's engine, we shall now proceed to explain the manner in which it is set to work. Steam being admitted into the pipe Q (see fig. 3) it passes through the opening S into the circular chamber, and being there prevented from passing the line U, where the cone and plane come in contact, it presses against the upper leaf, which, together with the cone, then revolves in the direction of the dotted arrow. Now, as soon as the said leaf gets below the top of the opening T, the steam that has been acting escapes through that opening into the pipe R, and thence into the atmosphere or into a condenser. The opposite leaf then operates in a similar manner, and so on as long as steam is admitted.

Many as have been the engines contrived for the production of rotary motion, we recollect none in which that result has been obtained by such a perfect harmony of operation among the different parts. Not only the general action of this engine, but the action of every part of it is rotary. The consequence is that it is wholly free from those serious drawbacks which make the attainment of a very quick motion, by means of a reciprocating-engine, a matter of so much practical difficulty. A vast increase of power is obtained, while the bulk and weight of the materials employed for the purpose are reduced beyond all former example. We shall endeavor to make this clearer by a few calculations.

The engine represented by the drawings (made to 2½ inch scale) presents to the action of the steam 12 square inches within the leaf, and is in a vertical position; but that being the maximum of surface exposed, a mean must be taken, which by the assistance of fluxions will be found to be ten square inches within a fraction.

By referring to the scale, it will be seen that the globular chamber of this engine is 13 inches in diameter. An engine of three times the size, that is, with a chamber of 39 inches in diameter, would, therefore, expose 90 square inches to the action of the steam; and the average distance performed by the leaf would be 7.35 feet for each revolution, and if the engine made 180 revolutions in the minute, 1,323 feet would be the distance passed in that time. If, now, steam of 45 lbs. pressure to the square inch were used, 4,050 lbs. would be the constant force in operation, which multiplied by 1,323 shows that 5,358,150 pounds would be raised 1 foot high per minute; and this sum divided by the established number, 33,000, gives for the general result 162 horses' power. Now, if we deduct one quarter for friction, &c. which, considering the harmonious action of the engine, is amply sufficient, the available power will be 120 horses!

That so great a power should be produced by a globular vessel of only three feet three inches diameter, is a result so extraordinary that the attention is naturally and anxiously drawn towards any probabilities by which it may be defeated. The probability of the action becoming affected by leakages first presses itself on our consideration. On this head it may suffice to observe, that as none of the packings require any other play than to be moved gradually against their respective surfaces as they wear away, all that is required to ensure tightness will be good workmanship. The next contingency which suggests itself is the ordinary one, of liability to derangement. On this score, however, there is but little to be feared, for the engine is of so few parts, and the mutual action and reaction of these parts is so simple and natural, that unless wantonly injured or obstructed, it can scarcely go wrong. We apprehend that the only real danger to be guarded against is the heat which may be ge-

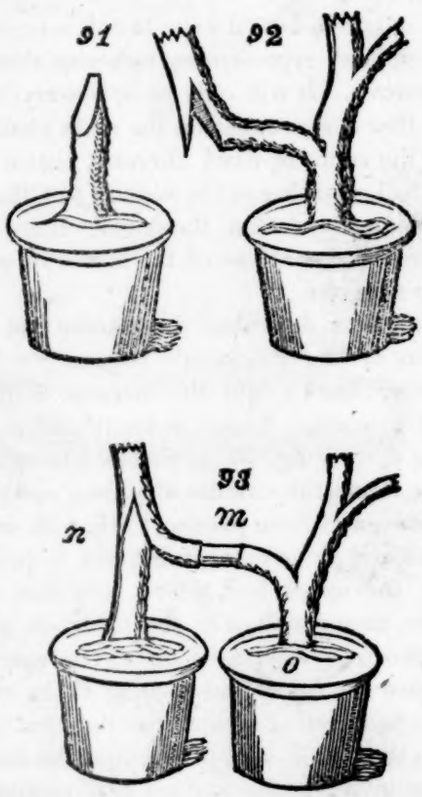
nerated by the rubbing parts, when the engine is put to its speed; between the bearings and gudgeons in particular, as they will have to withstand a great force. Experience can on this point be the only guide to a correct conclusion; but we incline to think, that as no inconvenience is found in cotton mills by giving shafts of a large size, and communicating great power, a velocity of 180 revolutions per minute, any deduction to be made on this account from the utility of the engine will be but trifling. As to the packing rings, the pressure on them will be but slight; indeed, their centrifugal force will be nearly sufficient to give them always an outword bias; the danger of their heating must therefore be extremely small.

It may not be amiss to observe, that the principle of the engine is such that the steam may be admitted from either side with equal effect. The motion can therefore be reversed, by merely reversing the inlets and outlets of the steam by means of a common slide valve or four-way cock—a feature of this engine, which, to say nothing of its speed, must render it particularly applicable to all locomotive purposes.

The branch of steam service, however, in which this engine is likely to be adopted with greatest benefit, is the marine. In steam vessels, lightness, compactness, simplicity, are all properties of the utmost importance; and doubly so, when they can be obtained, as in this instance, without any sacrifice whatever of power.

When water is employed to work this engine, the operation will be precisely the same as in the case of steam; with this exception, that the packing rings may be dispensed with. The exception, however, is of a nature which shows that, as a hydraulic engine it will work even better than as a steam engine; of this, however, more hereafter. At present, we trust we have said enough to satisfy our readers that the great space which we have devoted to this latest wonder of the mechanical world has been not unworthily occupied.

Woodworth's Patent Planing Machine.—A Machine patented under this title is now in operation at the Furnace of Messrs. Stickney & Yerrington, in this village. It is designed for planing, tongueing, and grooving, floor-plank, ceiling, &c. It performs the labor in a workmanlike manner, and what is unquestionably of much importance, brings the plank to an equal thickness and width. It will finish 18 feet of plank per minute, thus accomplishing an amount of labor equal to 35 men, during ordinary working hours, at an expense of about one-sixth the usual rate. It is far from being complicated in its construction, and is consequently not liable to get out of repair. Three knives are placed upon a cylinder, which revolves about 2300 times per minute, by which the planing is effected, and tongueing and grooving by a process somewhat similar. Should the location of the machine make it necessary to propel it by steam power, the shavings would evidently furnish a large proportion of the necessary fuel. The invention seems to be one of practical utility, and cannot fail of being an important acquisition, wherever building to any considerable amount is in progress.—[Lockport Balance.]



New Method of Grafting by Approach.—Cut off the stock in the form of a wedge, as in fig. 91, and cut the graft upwards, half way through, for a sufficient length, as in fig. 92; then place the graft upon the stock, as in fig. 93, and bind it on with bass and clay as usual, taking off a circle of bark between the graft and the root, as in fig. 93, *m*, which will cause the sap to flow through the graft into the stock *n*, instead of into its own root *o*. I recommend this method for grafting whenever the stock and the graft are of the same size, or very nearly so.—[Loudon's Magazine.]

[*From the Journal of Health.*]

SACCHARINE ALIMENT.—Dr. Prout considers the principal alimentary substances as reduceable to three great classes, the *Saccharine*, the *Oily*, and the *Albuminous*. The first of these, with certain exceptions, includes the substances in which according to Gay-Lussac and Thenard, the oxygen and hydrogen are in the same proportion as they are in water. They are principally derived from the vegetable kingdom, and being at the same time *alimentary*, Dr. Prout considers the terms *Saccharine principle* and *Vegetable aliment* as synonymous. The following, showing some of the results of Dr. Prout's experiments with various substances, great care being taken in every case to obtain these perfectly pure, will interest many of our readers, as showing the comparative nutritive properties of each.

SUGAR.	*Carbon.*	*Water.*
Pure Sugar Candy contains	42.85 pr. ct.	57.15
Impure Sugar Candy	41.15 to 42.15	58.50 to 57.50
East India Sugar Candy	41.90	58.10
English Refined Sugar	41.50 to 42.50	58.50 to 57.50
East India Refined Sugar	42.20	57.80
Maple Sugar	42.10	57.90
Beet-Root Sugar	42.10	57.90
East India moist Sugar	40.88	59.12
Sugar of Narbonne honey	36.36	63.63
Sugar from Starch	36.20	63.80
STARCH.		
Fine wheat Starch	37.50	62.50
The same dried	42.80	57.20
Do. do. highly dried	44.	56.
Arrow Root	36.40	63.60
The same dried	42.80	57.20
Do. do. highly dried	44.40	55.60

PORT WINE.—The eulogists of pure Port Wine may be a little startled at the following official statement of the entire amount of wine exported from Oporto:

In 1818, the Factory wine exported from Oporto amounted to 32,843 pipes; of this quantity 32,465 were consumed by Great Britain and her dependencies, leaving 378 pipes to supply all the rest of the world with pure port wine.

In 1819, the total quantity exported was 19,502 pipes, of which nearly the whole was for the supply of Great Britain.

In 1820, the quantity exported was 23,740 pipes; almost the whole went to supply Great Britain.

In 1821, 24,641 pipes; nearly the whole to Great Britain.

In 1822, 27,758 pipes; of which 27,470 were consumed by the English, leaving 288 pipes for the supply of all other nations.

In 1823, 23,578 pipes were exported; of which 23,208 were for the supply of England, leaving 370 for other nations.

In 1824, 19,164 pipes were the number exported, the same proportion being consumed by Great Britain.

In 1825, 40,524 pipes exported, of which 40,277 were for the supply of Great Britain, and 247 for other nations.

In 1826, 18,604 pipes exported; 18,310 to Great Britain, and the remaining 314 to other countries.

CONSUMPTION OF FRENCH WINES BY FOREIGN NATIONS.—According to M. Paguirre, England uses less of the French wines than almost any other nation, if we except Sweden. In five years, 6,681 tons of French wines were admitted into England. Hamburg alone takes about eight times, and Holland upon an average twelve times as much.

CONSUMPTION OF WINE IN FRANCE.—In 1821, the quantity of French wines retailed in France, and of course chiefly consumed by the poorer classes, amounted to more than 335,000,000 gallons. In 1826, it exceeded 400,000,000 gallons. The quantity sold wholesale, and consequently consumed by the families of the opulent, or at least those in easy circumstances, amounted in 1826 only to 60,314,650 gallons; in 1828, to 136,869,438 gallons.

CONSUMPTION OF BEEF IN FRANCE.—According to M. Lullin de Chateauvieux, it appears that the consumption of *Beef* in France, in proportion to the population, is only one-sixth of what it is in England, notwithstanding that during the year 1826 no fewer than 36,518 oxen and cows were imported from foreign countries. During the same period the importation of sheep and lambs amounted to 200,000. According to M. Dupin, there is consumed in England three times as much meat, milk and cheese, as in France.

LOSS OF WEIGHT IN MEAT DURING COOKING.—Four pounds of beef lost by boiling one pound, the same quantity lost by roasting one pound five ounces; the same quantity lost in baking one pound three ounces. Four pounds of mutton lost in boiling fourteen ounces; the same quantity by roasting lost one pound six ounces; by baking the same quantity lost one pound four ounces.

PORT WINE OF THE SHOPS—The following is stated on unquestionable authority to be the composition, detected by analysis, of a bottle of the ordinary port wine of the shops. Spirits of wine, three ounces; cider, fourteen ounces;

sugar, one and a half ounce; alum, two scruples; tartaric acid, one scruple; strong decoction of logwood, four ounces.

Stake Fence.—It is often said that the expenses attending houses and fences make slaves of many farmers. The Genesee Farmer recommends the following kind of fence as economical, and which is often seen in various parts of the country:

In making stake fence, the timber for stakes should be cut seven feet and a half long, and split to about the size of common rails; they should be set in the ground about eighteen inches, and each pair of sufficient distance the one from the other to admit a rail between them. When the stakes are thus placed, a stone of sufficient size to raise the lower rail from the ground should be placed between them, on which to place the bottom rail, and proceed to fill up by placing the ends of the two adjoining lengths of rails alternately.—After the fence is about four rails high, a hole should be bored through the two stakes with an inch and a quarter auger, and a pin of good oak, or some other durable wood, drove thro' it, and the smaller end made fast by wedging. This pin should be placed so high that, as the stakes at the top of the ground will first fail, their length will be sufficient to allow them to be re-set; and the lower hole bored in them should be at a such distance from the ground as will prevent its being brought to the surface on the second setting.

There should be two of these pins put through the stakes, the upper one only calculated to support the two ends of the upper rails, which may be raised a little above the other, and thus a fence with six rails may be made the height of seven, when allowed to rest upon each other. Such fence requires less labor for making than post and rail, by about the amount required to hole the post and sharpen the rails—is equally as durable as post and rail, and not more liable to be blown down by high winds.

Railroad Surveys.—The Board of Internal Improvements has made its Report to the Legislature, covering the Reports of Mr. Rawle, of his Surveys of the Central and Yadkin Railroad, which we will take an opportunity hereafter of presenting to our readers. We confess ourselves disappointed at the result which Mr. R. has come to in his estimation of the expense of constructing a Railroad between this City and Beaufort. The Citizens of Raleigh have just completed an Experimental Railway from the city to a Stone Quarry in the vicinity, which will not cost more than $2,500 a mile, and we had believed that the country through which the Central Road would pass is fully as favorable for such a purpose as that between this city and the Stone Quarry, yet Mr. R.'s estimate is upwards of $5,000 a mile. The expense of constructing the proposed Yadkin Railroad is estimated at between 8 and 9,000 a mile. And we presume, had Mr. R. continued his Survey of the Central Road westward, the estimate would have been still higher.

We fear that if the Central Railroad cannot be accomplished at a much less sum than Mr. Rawle's estimate, it will not, at present, be effected.

Would it not, in the mean time, be desirable, if a sufficient subscription can be obtained for the purpose, to continue our Experimental Railroad to some point on Neuse River, from whence good boat navigation could be had at most seasons of the year? The Road thus made might hereafter form a part of the Central Road.—*Raleigh, N. C. Jan.* 4, 1833.

Sisal Hemp.—Under date of Nov. 13, 1832, from Port Sisal, Yucatan, Dr. Perrine says:

"I am at this moment engaged in making confirmatory experiments with the Agave Sisalana. It is even much better than I stated in my paper on the Sisal hemp, There is a field of 5000 plants at only 2 yards apart, within three hundred yards of this table, in a very flourishing condition, although planted in the dry sand of the sea-shore, within two hundred yards of the water, which it is asserted will give at least three pounds each, annually, and need but one cutting; but as it makes very little difference *when*, a large plantation will supply work for dressing every day in the year. Heretofore it has been thought that the plant would not do well at less than 15 to 30 miles from the ocean, but this experiment shows that it will bear the sea air; and although its growth may be much slower, yet it produces sufficiently to stimulate cultivation in the worst places. Calculate for yourself 1210 plants to the acre of sandy sea shore, giving 3 pounds of Sisal hemp every year, after the first three or four, or we will even say 5 years, for ever and ever. Farewell at present, as I must see the Indian scrape six leaves of *Cheloin*, to compare their fibres with that of six leaves of the *Saoqui*.

H. Perrine."